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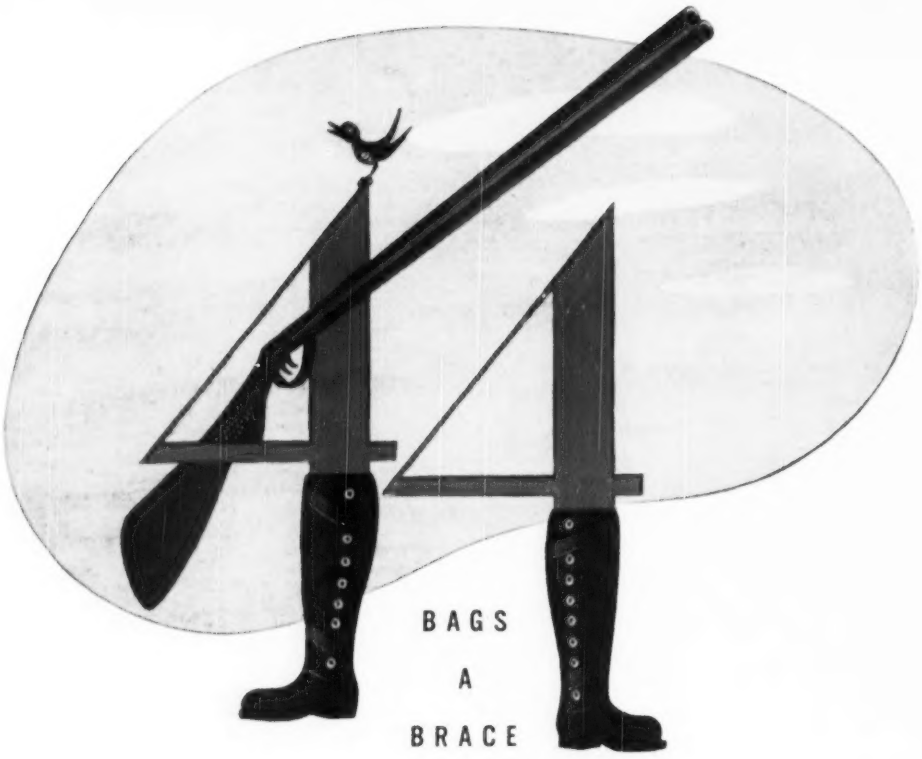

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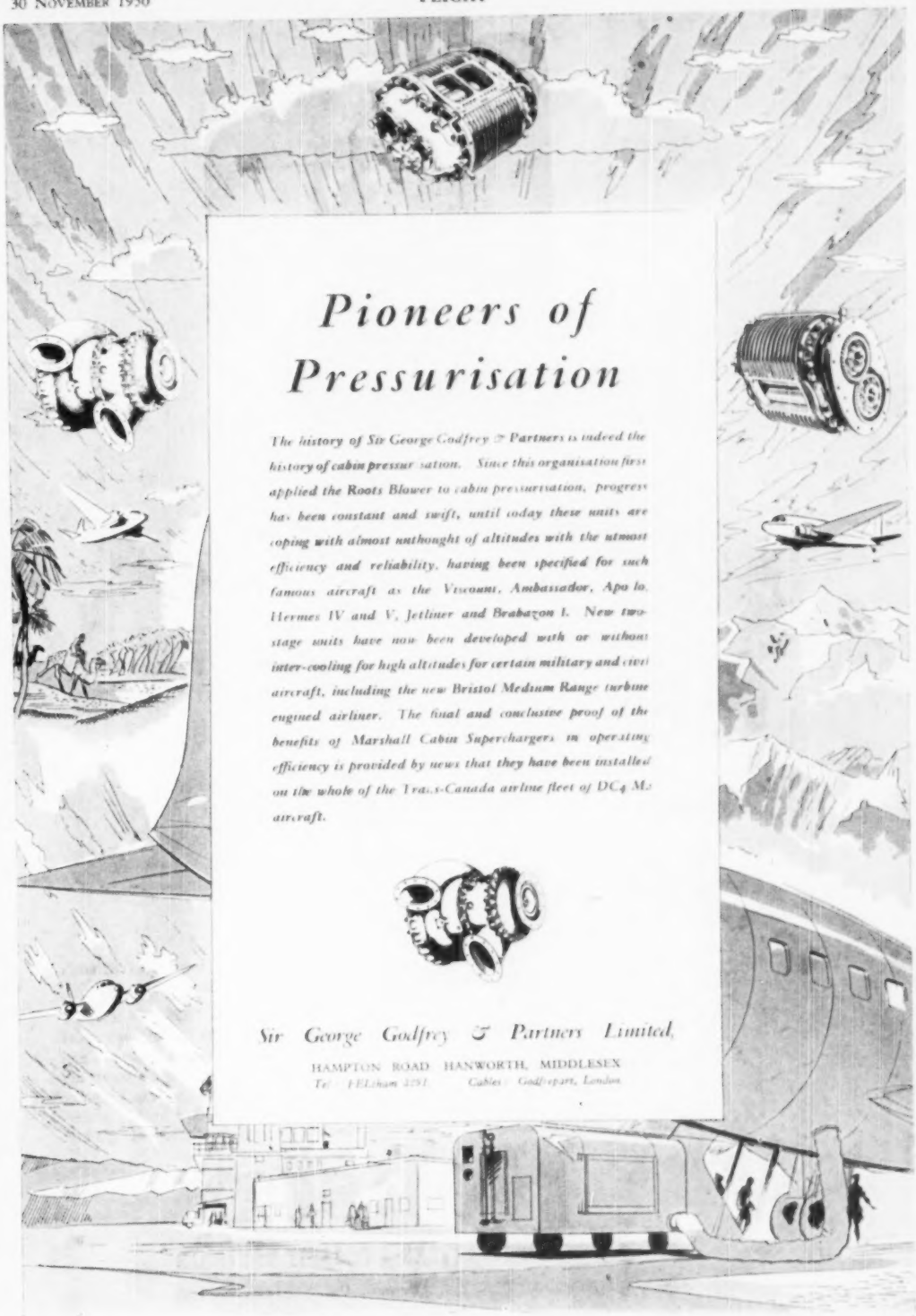

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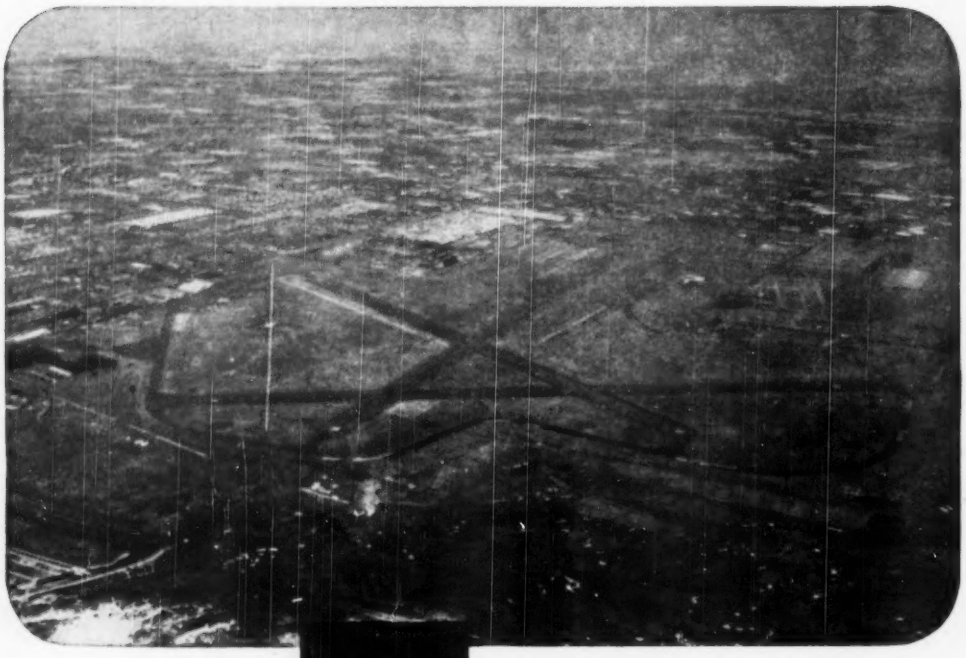

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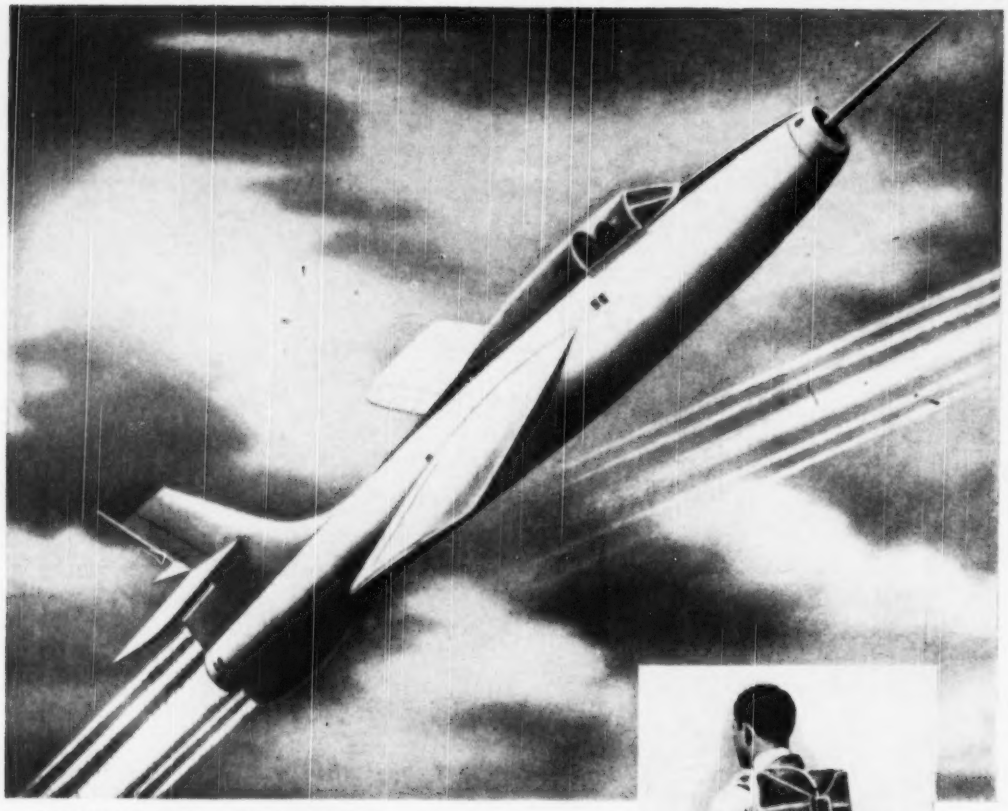

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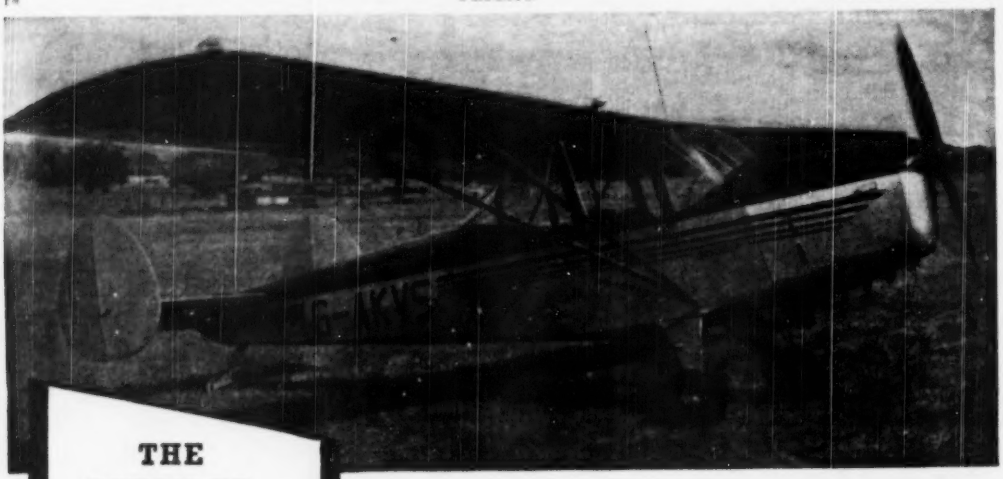

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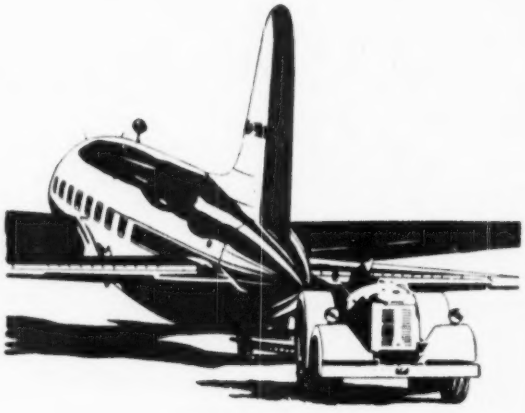

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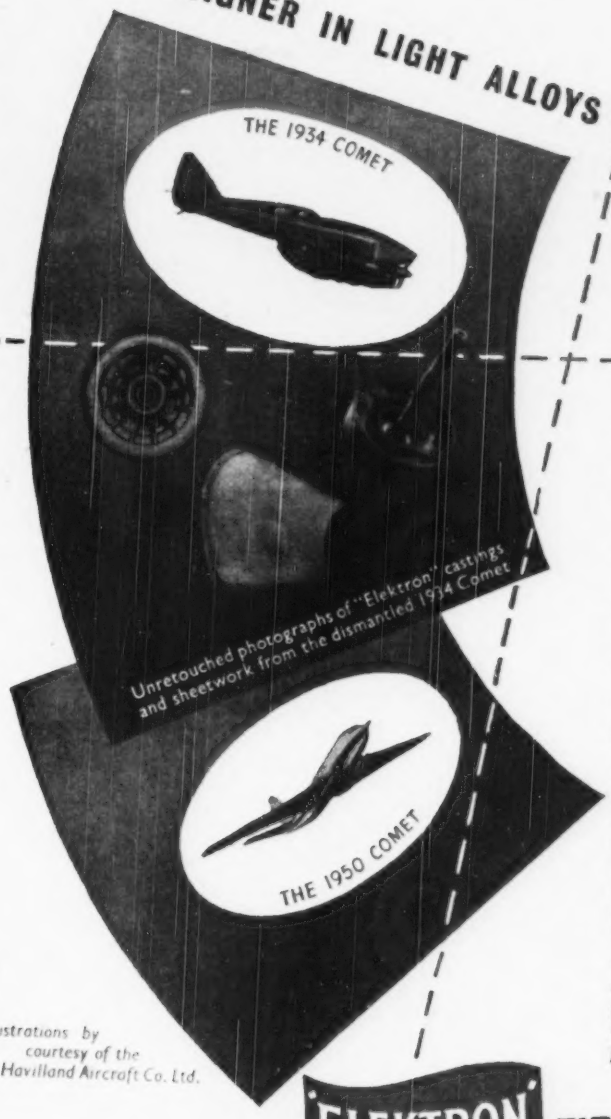
THE 1934 COMET
Unretouched photographs of "Elektron" castings and sheetwork from the dismantled 1934 Comet
THE 1950 COMET

Illustrations by courtesy of the De Havilland Aircraft Co. Ltd.

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First Aeronautical Weekly in the World

Founded 1909

No. 2184. Vol. LVIII. THURSDAY, 30 NOVEMBER 1950

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No News is . . .?

LAST week the Brabazon made unpremeditated news when members of the Bristol Aeroplane Company's staff expressed personal opinions apparently without official sanction from the company—a practice usually frowned upon in the aircraft industry, as in most others. Perhaps, like *Flight*, they thought it was high time that something more was said about this enterprising though costly national experiment which pops up at London Airport from time to time and which has now borne certain Ministers aloft.

During the constructional period regular and informative bulletins were issued, and the news service built up to a climax at the time of the first flight. Since that time, however, it seems to have been the policy to release less and less information and to-day the aircraft is being treated almost in the manner of a security-shrouded military prototype. In making this comment we must add that we think it unlikely that any blame for the shortcomings attaches directly to the public relations staff.

Here, as elsewhere, in the absence of official news all kinds of embarrassing "information" is liable to be passed round and many an old story dragged up. Thus, one hears once again that the Brabazon I has cost approximately £14 million, that it is suffering from engine-vibration troubles and, now, that it will not be flown across the Atlantic. Not long ago the public was confused by reports and disclaimers regarding the granting of a limited C. of A.—this following the fiasco of the first passenger-flight experience which was to have been given to Ministers, officials and members of the Press.

There are still many normally well-informed people who believe that the Brabazon was made large purely and simply because someone thought it was a good idea to build a giant aircraft. That range, payload and performance requirements on the North Atlantic route were settled in advance, and that it was these that dictated the minimum size of the aircraft, is left unstated.

Atlantic or Not?

In the *Daily Herald* Bristols' chief designer is quoted as saying: "It is not intended to take the Brabazon across the Atlantic . . . but have no doubt about one thing: Brabazon I could fly the Atlantic non-stop and with safety." He added that the aircraft was built purely for experimental purposes and to deviate from those would delay its progress. As the aircraft is a prototype of a transatlantic transport design one would have expected that flights to the American continent would feature in the development programme. Judging by this same report, however, it does seem that the Brabazon will fly outside the country during 1951, and its first sea crossing is likely to be to Shannon Airport in Ireland. At present the aircraft is on the ground, reportedly for the fitting of rubber mountings to its eight engines.

A Mr. G. P. Hebden of the same company, speaking to the Taunton Rotary Club, did well to point out (according to a press agency) that the quoted cost of £14 million for the Brabazon had mostly gone into runways, hangars, special test equipment and, the most valuable of all, "know-how." He believed that insurance value of the prototype at the time of the first flight in September, 1949, was only a little over £1 million. He continued encouragingly, but in contradiction of the chief designer's statement: "After doing the necessary number of hours around the country we hope to be in a position to cross the Atlantic and to demonstrate that the Brabazon is in truth the first airliner to be able to fly non-stop from London to New York." Mr. Hebden also stated that the turbine units of the second Brabazon would increase its speed by about 100 m.p.h., "but when this one is ready will probably depend largely on national policy."

Flight feels that the Brabazons are in a class of their own and that the great interest manifested in them by the British public—who look forward to the day when B.O.A.C. may operate such aircraft direct to New York—should be fostered both for the benefit of the aircraft themselves and for aviation as a whole. Moreover, taxpayers have lately grown accustomed to asking how the other half of their salaries is being spent.

Round Africa's Little Airstrips With a Gemini : Some Lessons and How They Were Learned

By J. S. HEMMINGS, A.F.C.

The author (right) and his engineer, Mr. Stuart King, on the stormy day of their departure from Croydon to make an air-mission survey.

OFF THE BEATEN TRACK

This brief article, by a pilot who has investigated the possibilities of light aircraft for missionary work in Africa, suggests that the author learned his lessons the hard way, and it may be that more thorough enquiry before the tour began would have avoided some incidents that, with a less resourceful crew, could have proved calamitous. Their experiences are worth bearing in mind by all who may at some future time have to fly aircraft of comparatively low power into and out of primitive airfields at high altitudes.

ALTHOUGH route-blazing has passed its peak for airlines, there still arise occasions, in other spheres of air operating, when a little exploring is required. To probe into the possible uses of aircraft for missionary work, the Missionary Aviation Fellowship recently sent a Gemini to Central Africa, with Stuart King as engineer and myself as pilot.

Being used to neither high-altitude airfields nor light aircraft, we found ourselves learning a great deal as we went along—knowledge that proved to be the answer both to scepticism and over-enthusiasm.

The first rude awakening as to what Africa held for us came when we struck Asmara, in Eritrea. As R.A.F. briefing in Khartoum had informed us that gooseneck flares were available at Asmara on request, we did not worry when the E.T.A. worked out to be 15 minutes after last light. The time was to have been 'phoned through, but, African telephone lines not always being what they might be, the message never got through. Thus we arrived over Asmara in darkness and found not a sign of a flare-path anywhere. It was, however, a clear night and, by the help of the briefing chart, the light of the stars and the glow from the west, the white runways were located. We decided to land and, making a gentle approach with plenty of motor, groped for the ground, bumped and rolled to rest in half of the ample length.

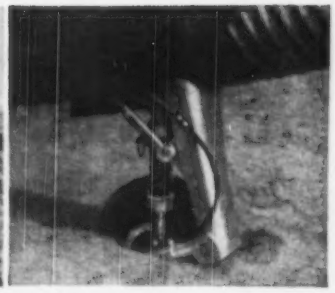
The morning light brought us nearer to a mishap than had the previous night. Asmara is 7,500ft high. I made the mistake of putting down 15 deg of flap, the recommended setting for shortest take-off. While the flap gets one nimbly off the ground, it retards acceleration through the next 10 m.p.h. The effect on this occasion was completely to prevent acceleration past that point, leaving us 5ft in the air, with the runway disappearing beneath us and no sign of increase in either speed or height. Low hills ahead, and strong doubts about our ability to turn, left only one course. Mercifully the emergency release on the Gemini's undercarriage shoots it down as from a gun. Stuart King pulled the knob, the lights came on like two green eyes and, closing the throttle, we dropped on to the rough ground. The wheels rumbled savagely across the ruts of a ploughed field and came to rest after 50 yards. After two hours of taxying and pushing we were once more safely parked on the apron, and eventually we "escaped" from Asmara by sending most of our kit back by B.O.A.C.

High temperatures on airfields at over 5,000ft altitude caused a minor snag. When the engines were stopped after a flight, vaporization of the petrol took place inside the cowlings. Heading the aircraft into wind, removing cowlings and spraying filter bowls and pumps all failed to overcome the trouble. The result was that we often had to wait a couple of hours for the engines to cool before we could take off.

Perhaps the most unusual strip to be used was in the Belgian Congo, where an American doctor, hoping to use a light aircraft himself, had cleared 400 yards of the forest. In all, about 4,000 trees and bushes had been uprooted. As often happens in Africa, while the employer's eyes were busy elsewhere, many of the holes were but loosely filled in; and although the earth took the weight of a car, it was not adequate for the Gemini's tiny wheels.

Having been warned that the strip might be soft, we first made a dummy run, bumping the strip with the wheels. It certainly felt a bit soft, but we decided to land. We stopped in 100 yards, up to the axles in sand and unable to move further. Two days later, early in the morning, the aircraft was emptied of everything except the pilot and a take-off test was made.

The Gemini against a background suggestive of stage mountains—Shell on the job at an airfield in the Sudan.



Left : After an uncomfortable moment at Asmara—the Gemini in a ploughed field following an unsuccessful take-off at 7,500ft. Right : "It felt a bit soft . . . We stopped in 100 yards, up to the axles in sand and unable to move further."

To taxi I had to use full throttle, someone had to push each wing tip and, when a wheel dug in particularly badly, half a dozen Africans put their backs under the wings and heaved. The firmest part of the strip was at one edge, which left a space of about 15ft between the wing-tip and the trees. Pushed for a start, we accelerated gradually; I lent myself to the feel of the stick, almost urging the wings to grasp every ounce of lift. Then, shaking itself free, the Gemini soared out over the tree tops like a bird from a trap. I landed with the feeling that it would not be safe with two up! When departure time came, I flew to a strip 70 miles away, Stuart King coming on with the kit and spares by road.

This strip, Luebo, was one of the land-uphill-take-off-downhill type; tearing down a rough slope is a great feeling and, if the wind is behind you, quite exhilarating.

Landing at Kindu, *en route* for Leopoldville, I made a prize boob. The airfield stood out, a clear brown against the green of the trees. Selecting the best of what appeared to be three parallel strips, I landed, noticing with considerable amazement and wrath that the field was covered with stakes. The lady who met us at the end of the run was obviously as amazed as we; she introduced herself as the wife of the constructing engineer! The strip in use was a mile away and, being grass, was less distinctive.

Perhaps the most unorthodox day's flying took place in Kenya, when we twice took the word of a missionary concerning landing grounds. The first was a war-time emergency strip. Some 7,000ft high, sloping, and with a stiff breeze blowing down the slope, it proved ideal for landing. To take-off uphill at that altitude was impossible; the only course was a downhill charge. Unloading everything, I tore down the slope; the ground speed seemed to get higher and higher while the A.S.I. stayed around 55 m.p.h. Passing the pole at the end of the strip, I pulled on the stick and the Gemini, shivering from nose to tail, took to the air. This time I did *not* land again!

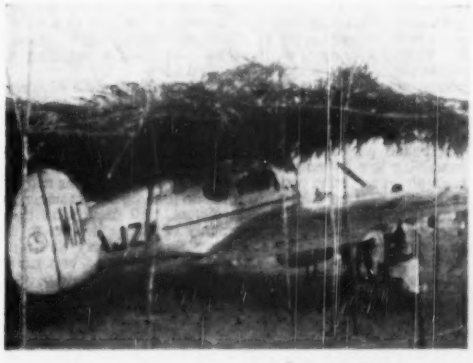
The second "guaranteed" strip was a stretch of sand on the floor of the Rift Valley which turned out to be ideally smooth, if a little short. To go one better, we cleared 400 yards of bush nearer the mission station and flew in to our home-made strip next evening.

Adverse conditions very nearly proved too great at Mungbere, in the Congo, where long grass and an absence of wind made the take-off sluggish. The 200ft forest trees loomed near and alarmingly high, and contact with them seemed inevitable, when suddenly I saw a gap through which a railway ran. Turning slightly from the grasping branches we kept over the railway until we had sufficient height to escape them. Two of my passengers said the flight was wonderful; the third was a pilot!

Despite our expectation to the contrary, weather was not a troublesome factor. The occasional storm had to be avoided, and from Costermansville and Nairobi we had to take-off and climb through ten-tenths to 8,000ft into the sunshine, where the clouds drift round the highest peaks.

In Kenya, prisoners are not usually given work on Saturday afternoons. When, one Saturday, 200 yards of grass had to be cut to make an airfield serviceable, the rule was relaxed and a score of men finished the job in an hour.

In Central Africa aircraft could help missions considerably, but the present travel facilities are such that the time and fatigue saved by air is insufficient to justify the expense. In the Sudan the position is different; aircraft can radically effect missionary work and permit it to spread beyond the reach of the road and river systems. It is there that by God's grace we shall endeavour to use the aeroplane for the extension of His kingdom.



A temporary "hangar" erected in 20 minutes to shield the Gemini from the sun. (Right) Two village chieftains, making their first acquaintance with the "whiteman's bird," pose proudly before the aircraft.

ROCKETS and R.A.T.O.

A Digest of Mr. A. V. Cleaver's Lecture to the Royal Aeronautical Society

ON Thursday, November 23rd, a paper, *Rockets and Assisted Take-off*, was presented before the Royal Aeronautical Society, by Mr. A. V. Cleaver, A.R.Ae.S. The lecturer is in charge of the rocket development activities of the de Havilland Engine Company.

By definition, said Mr. Cleaver, a rocket motor was a type of jet-propulsion unit provided with means within itself to generate all the material of its propulsive jet. If, as was usual, this consisted of the end-products of a combustion process, then not only the source of energy (the fuel), but also the source of oxygen with which to burn the fuel and release that energy, was carried along. The oxygen carrier (oxidizer or oxidant) and the fuel were both termed propellants, and might be supplied to the motor in a solid, liquid or gaseous form. In any case, complete independence of the surrounding atmosphere was achieved. Single compounds, or mixtures in which both fuel and oxidant were combined, were known as monopropellants, and liquid-propellant rockets (with which the lecture was mainly concerned) could use monopropellant systems: nitro-methane, hydrazine, and various organic nitrates were all examples of liquid monopropellants. Such systems had not yet found wide application, due to their critical nature, and what might by now be termed the classic type of liquid-propellant motor carried its fuel and oxidizer separately, and hence was known as a bi-propellant type.

The propellants were injected into the chamber, atomized, mixed and burned at high efficiency; thereafter, they expanded through a convergent/divergent nozzle to produce a supersonic propulsive jet. The minimum cross-section of the nozzle determined the chamber pressure for a given through-put of propellants, while the chamber temperature was a function almost entirely of the propellants and mixture ratio used. Lower temperatures could be obtained by running at propellant-mixture ratios departing considerably from the stoichiometric ("chemically-correct") value, and such a course was often followed to ease the severe cooling problems encountered. Because of these, one of the propellants was usually circulated in a jacket surrounding the chamber before injection on a regenerative coolant system. If the burning time was short (as in assisted-take-off units) an uncooled chamber could be used, either one of high heat capacity, or one constructed of some refractory material.

Reaction Processes

Chamber pressure exerted only a secondary effect on flame temperature, through the mechanism of dissociation effects—i.e., the tendency of the gaseous products to revert into simpler forms as their temperature was raised, so absorbing some of their available energy and reducing the final equilibrium temperature, e.g., $H_2O \rightarrow H_2$ and O_2, $CO_2 \rightarrow CO$ and O_2; $H_2 \rightarrow H$. These effects were rather less marked at higher chamber pressures, so that the intended combustion reactions went further towards completion, and the flame temperature, in consequence, was somewhat higher.

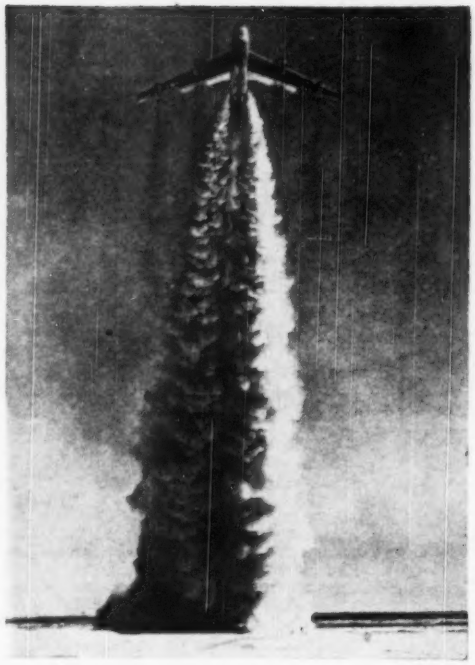
The lecturer thought it might be as well to qualify the use of the terms "fuel" and "oxidant," and to make it clear that any exothermic chemical reaction which could be made to take place in the chamber could form the basis of a rocket motor. Usually, the reaction employed was the combustion of a fuel in an oxygen-rich atmosphere, but this was not essential. Fuels could be burned with fluorine, for example, when no oxygen was present—although a rocket engineer would still adopt the convention of referring to whatever fluorine compound was used as the "oxidant." Again, extensive use had already been made of low-energy systems, utilizing the catalytic decomposition of hydrogen peroxide ($2H_2O_2$ [liquid] $= 2H_2O$ [gas] $+ O_2$ + 380 C.H.U./16)*. Here, although oxygen was present, there was no combustion of a fuel with it.

The thrust of the rocket motor was extremely high, relative to its size and weight, for two reasons. The first and more obvious was the essential simplicity of the mechanism; the second was even more fundamental. In a rocket motor, the mass-flow through the system was small for a given thrust, and, moreover, a high density of working fluid was maintained throughout. All pumping operations were carried out with the fluid in its liquid phase (the analagous argument for the solid rocket was self-evident), and liquid pumps were inevitably much smaller than, for example, air compressors. Once the gaseous phases of the reaction were attained, the rocket motor was normally working at chamber pressures of at least 300 lb/sq in (at all altitudes) as compared with the 60 lb/sq in typical of the gas turbine at sea level (and this was a figure which decreased with altitude).

The high specific consumption of the rocket motor was, of course, unfavourable, and even the most enthusiastic of rocket advocates would not suggest that rocket propulsion could be employed other than for short durations, simply because of this factor. Since the heats of reaction of all possible chemical combinations were by now well known, it was idle to hope for any sensational discovery of a natural "super fuel." Indeed, the hydrogen/oxygen combination was usually regarded by rocket engineers as a sort of chemical ideal.

Any sweeping advances must come from the field of invention, or at least from nuclear rather than chemical discovery. It was conceivable that future research into the stability of matter might make it possible to manufacture synthetic highly-exothermic propellants, or to use monatomic hydrogen (recombining into its molecular form) as a monopropellant. More probably, it might be possible eventually to use nuclear reactors to supply heat to the working fluid (hydrogen, ammonia, or some other light gas) of rocket motors. All these were long-term possibilities, and were certainly of no application to the immediate aircraft case. Nor were they necessary to it; the correct attitude at present was surely to make the best use of existing propellants, in order to realize the potentialities peculiar to rocket propulsion. Progress in detailed engineering would enable the present performance optima to be improved—perhaps by as much as 10 per cent—but, broadly speaking, the limitations imposed by high specific consumptions had to be accepted.

In dealing with the choice of propellants, Mr. Cleaver remarked on the high cost of solid propellants, and cited cordite, which had been in large-scale production for many years, and had been the standard British solid propellant so far: it cost



The Boeing XB-47 employs 18,000 lb of take-off rocket thrust in addition to the 24,000 lb of its six General Electric J-47 turbojets.

* C.H.U.—Centigrade Heat Unit.

about £280 per ton. As shown in the curves, the empty weight of the installation mattered most for assisted-take-off units. The weights before firing could be derived by adding on to these empty weights the propellant charge weight given by: thrust/specific impulse × burning time. For the liquid propellant motors, the curves illustrated the superiority of the pump-feeding system for longer burning times.

As regards liquid propellants, the first essential was to realize the very wide choice available—in theory, from among any exothermic chemical reactions. So far as bi-propellant systems were concerned, it should be realized that, in general, any fuel could be burned with any oxidizer, although, in practice, the selection of a novel combination could involve considerable development work to solve problems of ignition, smooth and efficient combustion, and so on. On aircraft installations, there was an obvious argument for using conventional fuels (petrol or kerosene) and there was little to be gained performance-wise by employing more unorthodox fluids.

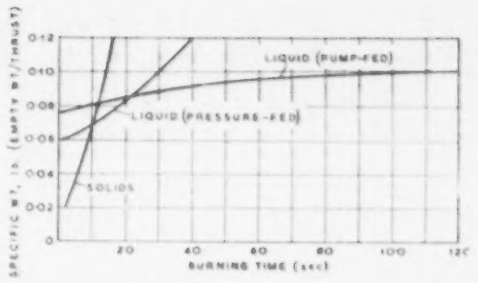
The case for unfamiliar fuels arose mainly in connection with the problem of ignition. Certain risks incurred during starting were thereby avoided, but only at the expense of introducing others in connection with storage, handling, crash consequences, and so forth. It was the lecturer's opinion that, on balance, such combinations were not the best choice for aircraft use, although they might well be so for some missile applications. The main choice rested between the many possible alternatives for the oxidant, but in practice, at least for the present, these reduced to the three fluids, liquid oxygen, nitric acid (99 per cent strength), and hydrogen peroxide (80 per cent strength). Each of these had its merits and disadvantages, and the same lack of any universal superiority of one or the other emphasized the fact that the choice could be made only for a particular type of application. Considerations of personal judgment and experience would also influence the choice as they always did in matters of engineering compromise. Mr. Cleaver further gave it as his purely personal assessment that the fugitive nature of liquid oxygen made it unsuitable for aircraft applications, and for such duties, either hydrogen peroxide or nitric acid (in that order) were preferable.

Detail Design

The general engineering problems were concerned chiefly with the demands made upon the large number of hydraulic and/or pneumatic valves, automatic and otherwise, which were invariably necessary in rocket motors. The design of these components was complicated by the fact that (a) large fluid-flow rates had to be handled; (b) the fluids concerned might have peculiarly different properties, e.g., corrosion (nitric acid), low temperature (liquid oxygen), or liability to decomposition (hydrogen peroxide); and (c) unpremeditated mixing due to leakage of highly energetic fuel combinations had to be prevented. This was particularly necessary with spontaneously-igniting propellants, but also required attention in other cases. Although an intimate mixture or emulsion of fuel and oxidant, in a dangerous ratio, was unlikely to be produced accidentally, the risk was potentially present and had to be avoided.

Heat transfer represented a physical effect imposing more arduous design conditions on the rocket motor than in any other engineering application. The Walter motor for the Me163, for example, ran at a relatively low chamber temperature (about 2,000 deg K) judged by rocket standards. Nevertheless, the heat transfer at the most critical part of the nozzle was still at the rate of over 200 C.H.U./sec/sq ft.

This most critical position was always near the nozzle throat, where the stagnation temperature at the boundary layer was still near to the bulk gas temperature upstream in the chamber, while the high gas-flow velocity eroded the thickness of the boundary layer until it provided only a thin insulation for the chamber wall. The use of internal "film" or "sweat" cooling, in addition to the normal regenerative system, operated to alleviate this condition in two ways. First, the evaporation of the film coolant itself provided additional local cooling; secondly, it restored a thick boundary-layer insulation. Such a technique could be applied (as on the V-2) by introducing one of the propellants through discrete holes, or by making the chamber wall itself of some sintered porous material. The latter method had not yet found much application because of construction difficulties.



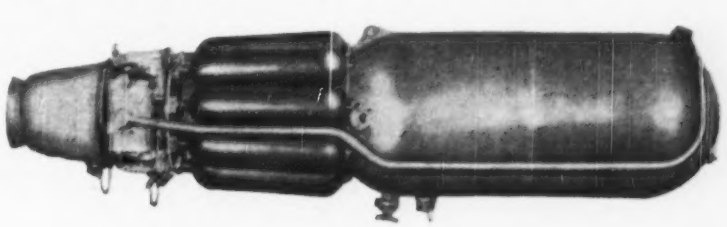
*Curves of specific weight of aircraft rocket power-plants as a function of total operating period. * The values are applicable to motors of circa 5,000 lb thrust, and include pump and tank weights, etc., but not mounting parts or cowlings.*

The choice of chamber materials was governed by the desire for two conflicting physical properties, good strength at elevated temperatures, and a high thermal conductivity. Thus, there was the paradoxical situation that ordinary mild steels, high-grade heat-resistant alloys, and aluminium alloys had all been successfully employed on rocket motors operated at temperatures of over 2,000 deg K. For uncooled, short-period motors, the use of graphite liners, ceramics, or the new metal-ceramic compacts ("ceramals" or "cermets") was of interest, as an alternative to using, for example, thick copper walls of high heat-capacity; the main difficulties to be overcome were those of construction of components in useful shapes and sizes, and of improving resistance to thermal shock when the motor was started.

Mr. Cleaver then gave a brief survey of the history of modern rocket work, in which he stated that Dr. Johannes Winkler was financed by the Junkers concern in 1929 to conduct experiments in rocket take-off assistance for seaplanes. British interest in rockets for take-off assistance first became pointed with the development of small, solid-propellant (cordite) rockets in 1940, and very little British work was done on liquid-propellant rockets until after the war. During the past two years, however, de Havillands had developed a large "cold" peroxide assisted take-off unit called the Sprite*. The "cold" peroxide system had been selected because of its simplicity and the large German background of successful experience with it; moreover, since the possibility of using the units had been foreseen at an early stage, they had been designed for internal installation in the wings of the Comet. The Germans, however, were developing liquid types even before the war, and one of the early projects of the great Peenemünde establishment was a petrol/liquid oxygen unit for assisted take-off.

Fairly extensive research on both solid and liquid rockets was in progress in America even before 1939. The Reaction Motors Corporation, formed by a number of the leading members of the American Rocket Society, developed several assisted-take-off units, and latterly had produced the power-plants for the Bell X-1 and Douglas Skyrocket research aircraft and for the Convair 774, the Martin Viking and other missiles. The Guggenheim Aeronautical Laboratory, California Institute of Technology, was also very prominent in this field, and the Aerojet Corporation was formed to apply the results of their research. Among the many rocket motors produced by this firm there had been a number, both of solid- and liquid-propellant types, designed for take-off assistance. The liquid-propellant designs

* *See "Flight," February 2nd, 1950.*



The de Havilland Sprite — a large "cold" peroxide assisted-take-off unit. Provision for two Sprites is made in the Comet. The "cold" peroxide system is simple and is backed by a wealth of German experience.

ROCKETS and R.A.T.O. . . .

had mainly used nitric acid, either with aniline or petrol. This work could be regarded as still within the experimental phase, but the standard Aerojet solid propellant unit (1,000lb thrust for 12 seconds; empty weight 115lb) had seen widespread operational use. It had been certificated by the C.A.A., and was used by airlines on freight operations; it was also regularly fitted on American military and naval aircraft when a specially short take-off run was demanded.

The view was sometimes expressed that aircraft should not, in any case, require assisting into the air. Certainly, it would be most undesirable to initiate a design trend (by airworthiness regulations or otherwise) which encouraged the regular delivery into the air of aircraft which were, thereafter, deficient in performance or handling in the event of engine failure. There remained, however, the question of emergency operation; take-off from small airfields, carrier decks, and the operation of turbine-powered aircraft from tropical or high-altitude airfields.

As compared with competitive forms of take-off assistance, the rocket method had the following clear advantages:—

(1) It required no extensive and expensive permanent ground installations as demanded, for example, by catapult schemes. If the assisting rockets were fitted not to the aircraft but to a launching trolley (e.g., with the object of dispensing with an undercarriage) then the ground installation would be simplified.

(2) It could provide assistance at the point where it was most needed—toward the end of the run, or even at the start of the climb. Whilst it was true that the benefit to take-off was roughly proportional to the total impulse (thrust-time integral) provided, it was usually preferable to concentrate this into the part of the run made at higher forward speeds when the available thrust corresponded to a higher useful thrust horsepower. Such a policy was also favourable in connection with piloting techniques, the rockets being fired after passing the critical speed for engine failure during period of take-off.

(3) It could provide unlimited amounts of assistance, which might be required on certain extreme applications. In this respect, the rocket had an advantage over any scheme for temporarily boosting the thrust of normal engines.

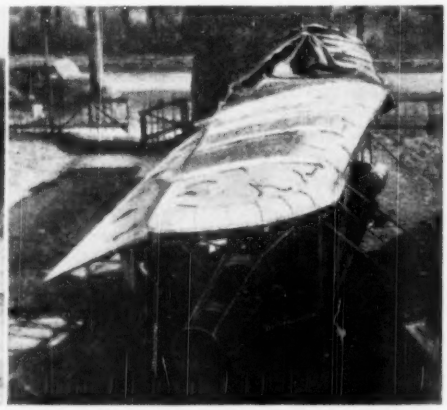
The last point would assume greater force if the current trend toward higher wing loadings (especially manifest in America) was continued. The Boeing XB-47, for example, employed 18,000lb of rocket thrust in addition to the 24,000lb of its main turbojets; its wing loading was of the order of 100lb/sq ft. As even more extreme examples of rocket take-off assistance for military aircraft, some of the war-time German projects were worthy of recall, e.g., the Natter intercepter, the 13-ton winged A-9 missile and Sänger's design for a rocket-propelled bomber of global range. Without going quite so far into the realm of visionary developments, these examples could still be accepted as indicative of what rocket assistance could provide if called upon, even for aircraft of rather more conventional form, and irrespective of the type of main propellant. The possibilities of rockets for the take-off acceleration of future ramjet aircraft (or winged missiles) up to the air speeds at which they were self-accelerating, perhaps constituted one such extreme field of application which might become very important.

THE CARLAT HELICOPTER

An Interesting American Experiment in Applied Aerodynamics

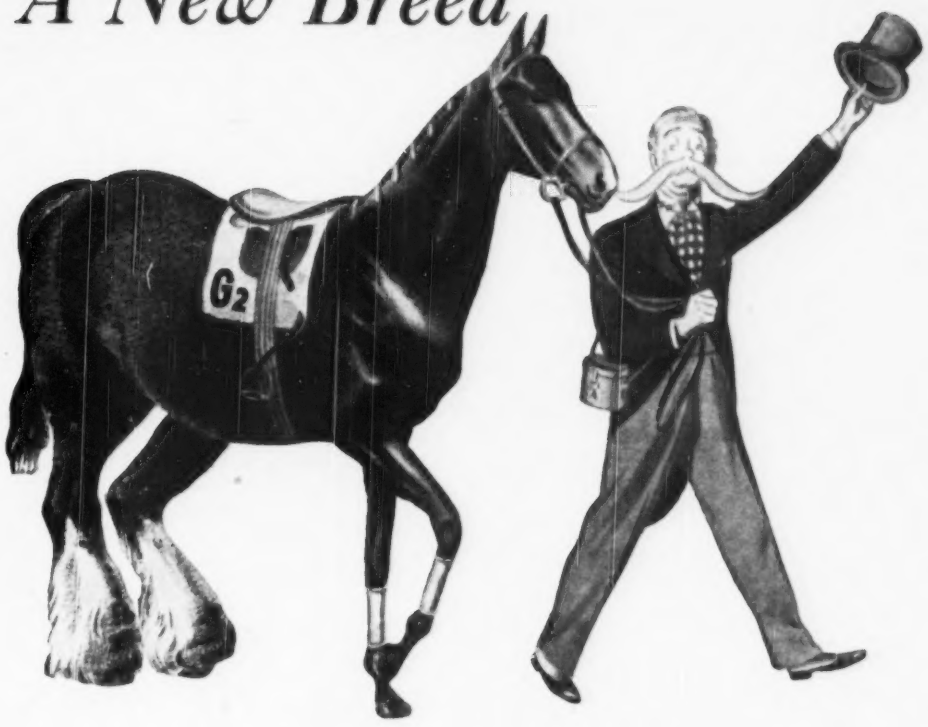
IT is common in human nature to concentrate on immediate problems and, in so doing, the specialist is frequently so concerned with recent trends of thought that he fails to look sufficiently far back to see what the work of very much earlier experimenters has to offer. Every now and then, however, someone applies a well-established but half-forgotten theory to modern needs, and the results are sometimes startling. The Carlat helicopter now in process of development in the United States is a case in point, and although it would be too sweeping to state that it has so far shown startling results, the whole basis of the design, and the results which have already been experimentally obtained, are certainly interesting.

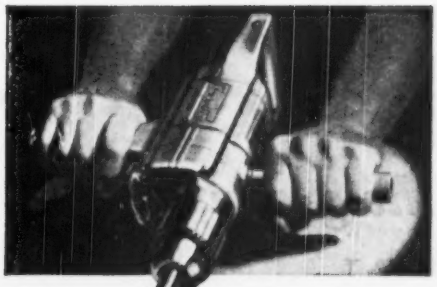
Shortly after the war, five engineers who shared a belief that boundary-layer control could be made to produce dividends in wing performance grouped together to form the Carlat Development Corporation in New York City. They built themselves a low-speed wind tunnel with a 22in-square working section, wherein they tested a variety of aerofoils, to which they applied differing means of boundary-layer control. A wing was evolved which, apparently conventional, differs from accepted practice in that the leading edge is formed with a narrow full-span slot venting upward. Air under pressure is ducted to the slot, and in escaping to atmosphere, flows over the top surface of the wing and so creates an area of reduced pressure near the leading edge. This system is clearly an adaptation of the Baumann proposals for achieving boundary-layer control by ejection, and there can be little doubt that the initial flow form is on the lines suggested by M. Henri Coanda for augmenting fluid flow. The effect of the boundary-layer-control aspect of the design was established by tunnel tests which showed the wing to be capable of creating lift even at an angle of attack of 50 deg. This in itself is not, of course, a discovery in the real sense; many years ago, the N.A.C.A. succeeded (by boundary-layer suction, i.e., by the Prandtl method) in maintaining a steady and unbroken flow over the upper surface of a thick aerofoil at an angle of attack of 58 deg. However, the Carlat engineers also found, somewhat to their astonishment, that the action of the ejection slot was also to create a forward pull on the aerofoil. On this basis—perhaps, to some extent, unrealistically—they visualized an aircraft of flying-wing type,



In its present guise, the Carlat helicopter is an overweight test machine to prove the preliminary characteristics of the wing. The whirling-arm test-rig may be seen in the background. In the view on the right the narrow leading-edge slot can just be discerned. The tip slots are stated to be of use chiefly in the suppression of tip vortices, and contribute little to rotation.

A New Breed





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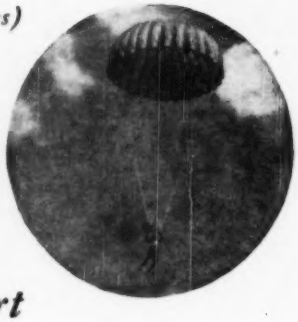

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	FRANCE	MEXICO	POLAND	

THE CARLAT HELICOPTER . . .

motivated at high speed solely through the use of the jet slot along the leading edge.

In order to test the tractive powers of the slot, the Carlat experimenters constructed a whirling-arm test-rig. Test wings were mounted at the end of the arm, and air under pressure supplied through the arm to the specimen. The ability to create tractive effort was so great that one of the first wings tested caused the device to rotate at such high speed that the wing finally broke loose and flew off the arm. Naturally enough, the next step envisaged was the construction of a full-sized wing, but as test flights would, necessarily, require the use of an airport, and because the Carlat group wished to maintain secrecy about their development, it was decided that a rotating wing would be sufficient to demonstrate the effects whilst, at the same time, it could conveniently be constructed in the small shops they had at their disposal. After two and a half years' work, the Carlat helicopter emerged.

The rotating wing is constructed with light-alloy spars and skin, but the chordal ribs are riveted on the exterior skin surface in order not to obstruct the ducts supplying air to the slot. It was found that an equable distribution of air to the slot was critical in its effect on the aerofoil, and this occasioned one of the main problems in the design of the ducting. Air is supplied from a drum-type centrifugal blower driven by a 185 h.p. Lycoming engine; the sole purpose of the engine is to drive the blower—there is no mechanical drive to the rotor.

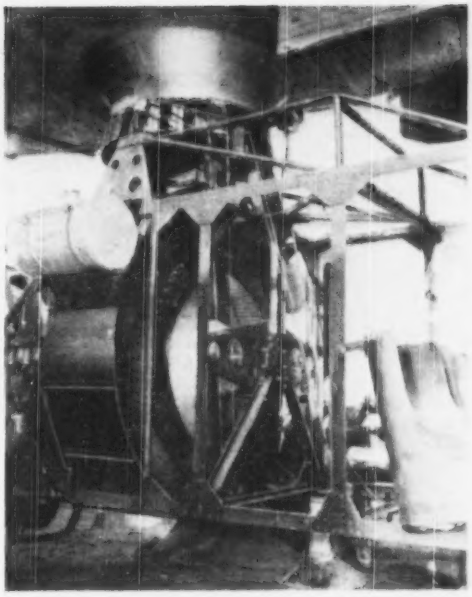
Performance and Theory

The fuselage of the helicopter is little more than a trusswork frame in which the engine is installed, and upon which the rotor is supported. The fuselage is, however, provided with a tricycle landing gear, and a full set of flight and engine controls and instruments is installed. Tests of the stability, lifting power and control have been conducted with the machine over the past two years and, it is stated, the results have been gratifying. The wing has been made to rotate at over 180 r.p.m. by means of the slot-induced traction alone, and has created enough lift almost to fly the 1,500 lb overweight test-bed from its moorings.

It is stated that cyclic-pitch and collective-pitch control are obtained by means of aileron-like flaps which are actuated through gimbal-ring assemblies in the hub. In the illustrations of the Carlat helicopter available here, there is no indication that the rotor is anything but a rigid beam supported at the centre, and we find it difficult to reconcile claims for stability (except, possibly, in the still-air hovering condition) by a rotor the individual halves of which are not articulated so as to permit at least some variability in zenithal and azimuthal movement.

The claims relating to the slot effect are, however, somewhat easier to reconcile in the light of the Baumann and Coanda researches. In the absence of data from the Carlat group, we can only conjecture that the slot action is explicable along these lines. That is to say, with the wing at rest, the ejection of air under pressure through the slot will not only create a low-pressure area along the leading edge immediately above the slot, but in conformity with what has been called the Coanda effect, the flow-path of the air issuing from the slot will tend to bend and follow the profile of the leading-edge top-curvature. Furthermore, the flow will be augmented by inducing sympathetic movement of the adjacent air volume immediately forward of the leading edge. Thus, a state of affairs exists when, with the wing stationary and air being ejected through the slot, a low-pressure area is created, and the slot outflow inherently tends to conform to the leading-edge curvature: the wing will therefore tend to move forward into the low-pressure area, and thus (in the case of the helicopter) rotation is initiated. We should imagine that acceleration of the rotor would be fairly slow, although the magnitude of the low-pressure area might perhaps be increased by the flow-augmentation derived by motion of the wing as a whole.

The Baumann part of the theory comes into effect only when the wing is in motion. The point on an aerofoil at which the boundary layer expands to such a degree that stagnation and break-away occur in the flow is a function of many variables: all we feel justified in stating on this point in relation to the Carlat wing is that the existence of the slot outflow on the leading edge could plausibly be held to delay expansion of the boundary layer by suppression, and therefore to retard the point of breakdown into turbulence to a position farther rearward than would otherwise be the case. Certainly, the position of the slot is unusual, most researches having pointed to the optimum slot-location as being considerably farther back—in fact, just upstream of the point at which separation occurs in the critical condition. It is, however, not unlikely that, in the Carlat instance, the Coanda effect may have some influence on the boundary-layer suppression characteristics.



The blower used to supply air under pressure to the slot is of centrifugal drum-type, and employs 120 aerofoil-section vanes. The control cables to the gimbal rings in the rotor pylon can also be seen here.

FORTHCOMING EVENTS

Nov.	30.	R.Ae.S. Graduates: "High-speed Flying," by S.L. John Derry, D.F.C.	Jan.	16.	R.Ae.S. (Belfast): "Landing Gear and Equipment," by H. G. Conway, M.A., F.R.Ae.S.
Dec.	1.	London Aeroplane Club: Annual Party.	Jan.	17.	R.Ae.S. (Preston): "Aircraft Materials," by Dr. H. Sutton, D.Sc., F.R.Ae.S.
Dec.	5.	Institute of Transport (Graduates and Students): "Passengers by Air," by D. O. Bustard.	Jan.	29.	R.Ae.S. (Weybridge): "High-speed Flying," by S.L. J. D. Derry, D.F.C.
Dec.	6.	R.Ae.S. (Brough): Members' Lecturettes, and Film Show.	Jan.	31.	R.Ae.S. (Weybridge): "Life and Work of S. F. Cody," by G. A. Broomfield.
Dec.	7.	Ariel Club (Air Ministry and M.C.A. Social and Athletic Association): Annual Ball.	Feb.	12.	Institute of Transport: Brancker Memorial Lecture—"Economic Aspects of Airline Operation," by Peter G. Masefield, M.A.(Eng.), F.R.Ae.S., A.F.Inst.A.E., G.Inst.Mech.E., M.Inst.T.
Dec.	7.	R.Ae.S.: "Relative Merits of Centrifugal and Axial Compressors"—Discussion between Dr. E. S. Moult, B.Sc., M.I.Mech.E., F.R.Ae.S., and H. Pearson, B.A., A.F.R.Ae.S.	Feb.	14.	R.Ae.S. (Brough): "Aero Engines," by A. Cdre. F. R. Banks, C.B., O.B.E.
Dec.	8.	R.Ae.S. (Preston): Annual Dance.	Feb.	14.	R.Ae.S. (Preston): "Testing Aero-engines and Power Plants," by A. C. Lovesey, O.B.E., B.Sc., F.R.Ae.S.
Dec.	9.	Surrey Gliding Club: Christmas Party.	Feb.	21.	R.Ae.S. (Weybridge): "Air Interception," by A. V.M. T. G. Pike, C.B., C.B.E., D.F.C.
Dec.	12.	R.Ae.S. (Belfast): "Boundary Layers at High Speeds," by Prof. A. D. Young, M.A., A.F.R.Ae.S.	Feb.	22.	Institute of Metals (Birmingham Section): "Metals for Gas Turbines," by J. M. Robertson, Ph.D., D.Sc.
Dec.	13.	R.Ae.S. (Preston): "Rocket Propulsion and Interplanetary Flight," by A. V. Cleaver, A.F.R.Ae.S.	Feb.	23.	R.Ae.S.: Fourth Louis Blériot Lecture: "Power versus Weight," by M. Maurice Roy.
Dec.	13.	R.Ae.S. (Weybridge): "Designing for High Speed," by Professor E. J. Richards, M.A., B.Sc., F.R.Ae.S.	Feb.	27.	R.Ae.S. (Belfast): "Aircraft Carriers," by J. L. Bartlett.
Dec.	13.	Herts and Essex Aero Club: Annual Dinner and Dance.	Mar.	5.	Institute of Transport (Metropolitan Section): "Air Transport by Charter Companies," by Capt. R. J. Ashley.
Dec.	14.	R.Ae.C.: Film Show, Londonderry House.			
Dec.	22.	West Riding Aviation Centre: Annual Dinner and Dance.			
Dec.	29.	R.Ae.S. (Weybridge): Annual Dance.			
Jan.	10.	R.Ae.S. (Brough): "Problems of High-speed Flight," by H. Davies, M.Sc., F.R.Ae.S.			

HERE and THERE

Heron Migrates

LAST Friday the de Havilland Heron feederliner, which had then completed 180 hours' test-flying, left Hatfield for Africa, *via* Nice and Malta, where it will undertake tropical trials. Take-off trials at Nairobi and hot-weather tests at Khartoum are planned.

New Honour for Whittle

SIR FRANK WHITTLE'S achievements in developing the gas turbine have been recognized by the Royal Society, which is today due to present to him the Rumford Medal. This award is made bi-annually to the author of the discovery which, concerning heat or light, tends, in the Society's view, most to promote the good of mankind.

Avon Production Increased

FOLLOWING last week's news that the Avon-powered Canberra jet bomber was to be built by four companies, plans are now announced for correspondingly increased production of the Avon turbojet. This powerful axial-flow unit is to be manufactured, both at Derby and Glasgow, by Rolls-Royce, Ltd., its designers; by the Bristol Aeroplane Company; and by Napier and Son, Ltd. The Rolls-Royce factory at Hillingdon, Glasgow, which will shortly begin production of Avons, employed 24,000 people on Merlin manufacture during the war.

As announced last week, the Canberra is to be produced by English Electric—the design firm—A. V. Roe, Short Brothers and Harland, and Handley Page. The last-named company, incidentally, announces that its contract for Hastings transports, reduced for economy reasons earlier this year, has been partly restored.

Tugs for Washingtons

NINETY heavy tractors of a new type are to be built for the R.A.F.; they will be used mainly for towing B-29 Washingtons of Bomber Command. Designated V.I.G. 1c, the new vehicle has been produced by David Brown Tractors, Ltd. It has a 7,500-lb designed draw-bar pull which can be increased by the addition of extra ballast. The design incorporates a reversing winch which pays out under power, and the tractor's gears may be changed in motion.

IN THE AIR: First flying picture of the Boulton Paul P. 111 delta-wing research aircraft (Rolls-Royce Nene)—taken during its first flight at Boscombe Down on October 6th. At the controls is S/L. R. H. Smyth, Ministry of Supply test-pilot. Note the tail-parachute housing.

Cartridge Starters for Turbojets

MODERN interception tactics, which demand the quickest possible "scramble" by defending fighters, indicate instant and reliable starting of turbojets. Though cartridge starting of gas turbines is not an entirely new development—a British-designed starter of this type was described in *Flight* over a year ago—there is interest in the announcement that Rotax have now introduced a cordite-actuated "turbo-starter"; it has been adopted by the R.A.F. and will soon go into production. Operation of the starter depends on the use of a cordite charge which, when ignited, energizes a small turbine; this, in turn, drives the aircraft turbojet up to idling speed—in about a quarter of the time taken by an electric starter. Two cartridge chambers—one "spare"—are provided.

PROOF POSITIVE. Since the gravure feature (on pages 492-493) which deals with Soviet fighters went to press, this photograph of the Mig-15 has come to hand. It confirms that, with the possible exception of the location of the wing on the fuselage, the drawing is correct in all essentials. A few additional details, including a wireless aerial and a projection aft of the rudder, are supplied by the photograph.

Customs at Luton

MANY private pilots will be interested by the news that airfield Customs facilities are shortly to be made available at Luton for a trial period of a year. Pilots will thus be able to fly to the Continent without having to obtain Customs clearance at airfields further south; additionally, Luton is on the edge of the London Control Zone and becomes a useful alternative destination in Q.B.I. conditions for returning pilots seeking an airfield with a reasonable train service to London.

AIRCRAFT OF THE YEAR

Notable British aircraft that have made their first flights, or been announced, during the past year will be the subject of a feature article in the Christmas number of *Flight* (December 21st): this will be an enlarged issue, with special articles in addition to usual contents.

Turbo-proposition

THE latest issue of *Aviation Week* announces that the Boeing Airplane Company has completed preliminary design studies on a 24-passenger turboprop-powered feederliner, available in two versions. The Model 498, powered by two Rolls-Royce Darts of 1,040 h.p., has a designed cruising speed of 255 m.p.h. at 30,000ft at a gross weight of 26,500lb. The second version, Model 498-4, has two 2,750 h.p. Allison T-38 turboprops and estimated performance data include 350 m.p.h. cruising speed at 35,000ft at 30,000 lb gross weight.

Design features of the aircraft are a high-position, high-aspect-ratio wing with turboprops underslung in slim nacelles, and a circular-section fuselage tapering sharply towards the tail. Although "virtually ready to be built," the aircraft is not likely to be produced until Boeings

AIR POWER: A Cirrus Minor engine driving a tractor airscrew provides power for this racy-looking craft, in which 59-year-old Mr. Wallie Davies of Dudley last month broke a world's speed record for 450 kg hydrogliders: subject to homologation, his speed was 51 m.p.h. When planing, the boat draws only 2in of water.

are assured of financial backing—either from an airline or the U.S. Government. British and American turboprop progress, incidentally, is reviewed on pp. 494-6 of this issue.

Preview for P.M.

THE Prime Minister, Mr. Attlee, and several Cabinet Ministers recently attended a private showing of William Courtenay's latest colour film, *Campaigning in Korea*. Mr. Courtenay, who gave a commentary, made the film while acting as Kemsley Newspapers' war correspondent in Korea; he hopes to show it to the Royal Aero Club and branches of the R.Ae.S. during the coming months.

Overland to Africa

WELL known as a private owner and Naval airman, Capt. C. W. Byas (lately Deputy Chief Naval Representative (Air), Ministry of Supply) last week began a 12,000-mile car journey to Southern Rhodesia, accompanied by his wife. During his trip he will undertake a survey for Tiltman Langley Laboratories, Ltd., the aircraft research and development engineers, who are considering the possibility of extending their activities to Africa.

Capt. Byas, who intends to settle on a small farm near Salisbury, has flown his Auster to several private-aircraft meetings and Continental rallies since the war. He has twice flown to Africa in light aircraft: in 1931, in a Comper Swift ("ditching" in the sea 20 yards from Cape Town), and in 1948, in an Auster.

NEWS IN BRIEF

THE annual general meeting of the Air League of the British Empire will be held at Londonderry House, 19, Park Lane, London, W.1, on Tuesday, December 19th, at 11.45 a.m.

* * *

Following the appointment of Jack Olding and Co., Ltd., as sole world distributors of the Vickers industrial tractor, arrangements have been made under which Vickers, Ltd., appoint two directors to the Board of Jack Olding and Co., Ltd. The first appointees are Mr. J. Reid Young and Maj.-Gen. C. A. L. Dunphie.

* * *

Mr. N. G. Bennett, M.B.E., A.R.Ae.S., has been appointed to the board of the Graviner Manufacturing Co., Ltd. He joined the company's aircraft equipment division in 1946 as chief engineer, and his experience of accident prevention and fire protection has, it is stated, greatly assisted the development of Graviner products in this field.

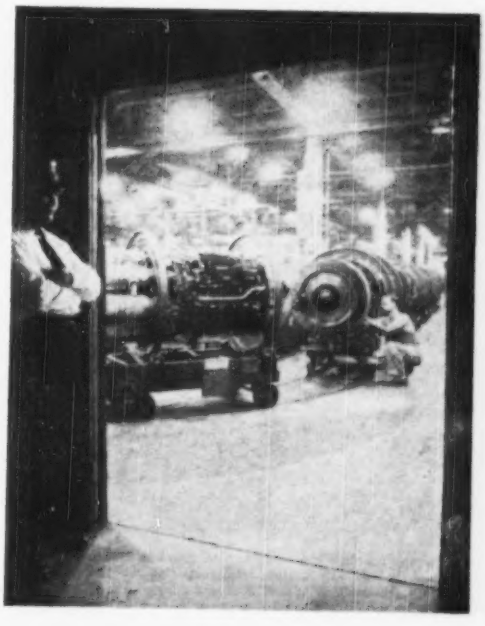
The new plant at the Shell Haven, Essex, refinery has come into operation six weeks ahead of schedule, and is already producing petroleum products at the rate of 1,450,000 tons a year.

* * *

Mr. B. P. Hough, of Sir W. G. Armstrong Whitworth Aircraft, Ltd., has recently moved across to the company's design and technical section, and publicity and technical sales will henceforth be handled by Mr. W. T. Dickie.

* * *

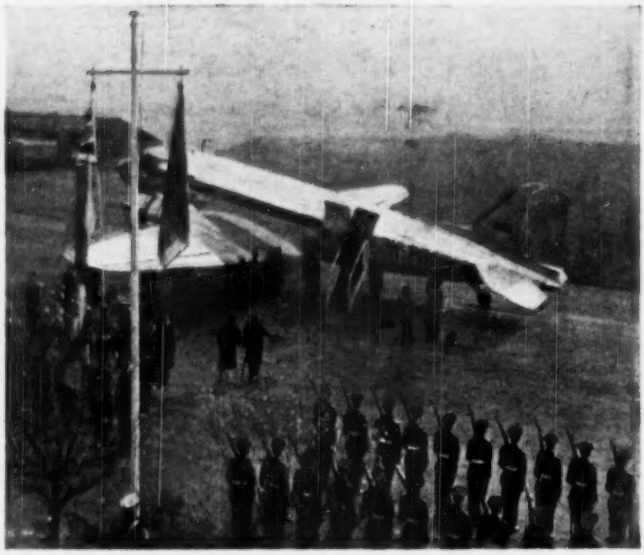
Major J. Vivian Holman, A.F.R.Ae.S., M.I.Ae.S., states that he has relinquished his executive posts with Radio and Television Trust, Ltd., and its subsidiaries. In both practical flying and administrative capacities he has been connected with the aviation industry for over 30 years. He remains a director of Bryans Aeroquipment, Ltd., and two of the Philco companies.



POWER REVEALED: Two types of American axial-flow turbojet seen from unusual angles. (Above) For easy maintenance, the port Allison J-35 (5,000 lb thrust plus afterburning) swings out of its mountings in the Northrop F-89 Scorpion, now in production as the standard U.S.A.F. all-weather fighter. (Right) A peep past the guard at the General Electric final assembly line for J-47s (5,200 lb thrust), which are the standard power-units for several American high-speed military aircraft.

PRINCE and PILOT

Bernhard of the Netherlands Flies Queen Juliana Home



The impressive scene at Northolt last Friday, when Queen Juliana entered the Royal Dakota to be flown home by Prince Bernhard.

THE cause of aviation owes much to the keen, practical example shown by Prince Bernhard of the Netherlands. Last week's warmly welcomed State visit by Queen Juliana and the Prince ended at 11 a.m. last Friday when the Royal couple left Northolt in a Dakota flown by the Prince himself. A Fighter Command escort of 18 Vampires from Odiham, led by W/C. A. G. Rawlinson, D.F.C., met the Dakota over London and conducted it out over the North Sea to a point 40 miles past Felixstowe. At Northolt, the R.A.F. was represented by Air Chief Marshal Sir Ralph Cochrane, Air Marshal T. A. Warne-Browne, and A.V.-M. D. F. Atcherley, with a guard of honour and R.A.F. Central Band.

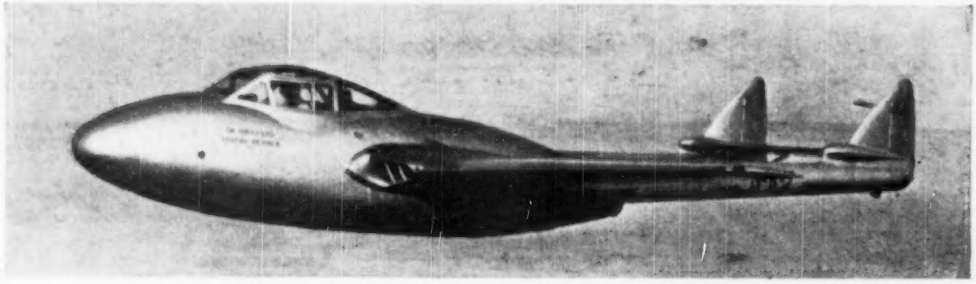
When the Queen and Prince arrived in Britain by sea on November 21st, an escort of 18 Meteors was to have been provided, but the aircraft were grounded by bad weather. During the visit, on November 23rd, Prince Bernhard made a thorough inspection of London Airport, where he was met on arrival by Lord Pakenham; Sir Miles Thomas; Sir John D'Albiac, the Airport Commandant; and A.Cdre. W. E. G. Mann, Director-General of Navigational Services, M.C.A.

The Prince also met three British members of the staff of K.L.M., of whose controlling board he is a member. He then visited the control tower, G.C.A. caravans and the London Radar operations room. Later the same day he visited the Brentford factory of the Sperry Gyroscope Company—the manufacturers of instruments in his personal Dakota. The Prince visited another airfield during his stay in Britain—Hendon, where he tested a Jaguar XK120 two-seat sports car on the runways.

Last September, during an informal visit to this country, Prince Bernhard called at the de Havilland Hatfield airfield, where he piloted a Vampire for 30 minutes and was also flown in the Comet by John Cunningham. Major Sonderman, personal pilot to the Prince, is well known for his brilliant demonstration flying, both in this country and on the Continent.

During the royal visit Prince Bernhard toured the Sperry Gyroscope Company's factory. He is seen here in company with Mr. Robert Broadbent (left), director and general manager, and Mr. Arthur Hillier, O.B.E., chairman and managing director. They are watching the testing of gyro elements for the latest Gyrosyn compass.

FIRST SIDE-BY-SIDE-SEATER JET TRAINER : THE D.H. 115



Latest of the de Havilland Vampire line, previous members of which have included fighters, fighter-bombers, deck-landing fighters and night fighters, is the D.H. 115 Vampire Trainer, a detailed description of which appeared in last week's issue of "Flight." This first air-to-air study brings out the clean nose-lines to particular advantage. The only directly comparable machines under construction are the Fokker S.14 and Fiat G.80.

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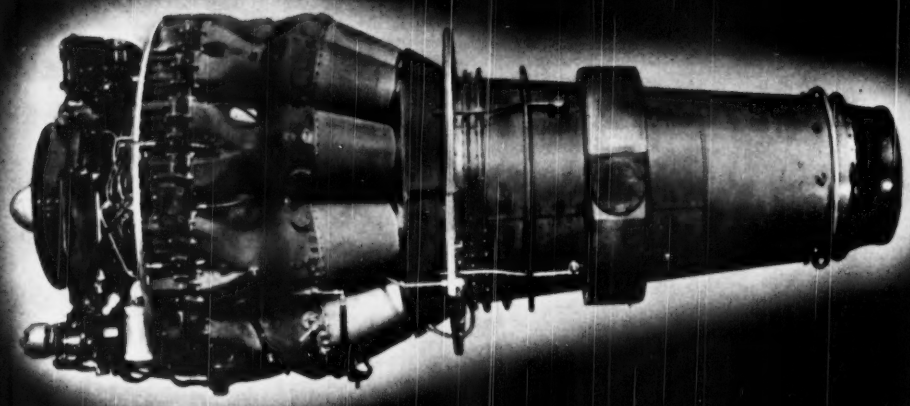


Large orders for Venom fighters for the Royal Air Force put the seal of recognition on the practical excellence of the Ghost

DE HAVILLAND

THE DE HAVILLAND ENGINE COMPANY LIMITED, EDGWARE, MIDDLESEX, ENGLAND

Typical of a large family of Avro flying test-beds is this Armstrong Siddeley Python-Lancaster. Merlins, here seen feathered, are retained inboard, but the two outboard Python turboprops can alone produce more power than all four of the piston engines originally fitted.

"Flight" photographs

DEVELOPMENT OF THE TURBOPROP

British and American Units and the Aircraft in Which They are Installed

FROM the earliest days of the Whittle aircraft gas turbine when this country and, independently, Germany, were alone making material progress towards producing a practical power unit, the possibilities of an airscrew-driving version of the new prime mover were foreseen. Naturally, the classic simplicity of the early Whittle turbojet appealed to engineers and received their full attention during the first years, but the turboprop was early in the picture, its capabilities realized and its probable range of speed and altitude for economic operation deduced. There has been little reason in the intervening decade to alter the opinions recorded at that time. The turboprop is still considered to be a strong challenger to the piston engine from the lower limits of 300 m.p.h. and 20,000ft and to the turbojet at speeds under 500 m.p.h. at the higher altitudes. Over a very small speed range—in the region of 500-550 m.p.h.—the ducted-fan turbine, which may be regarded as a variant of the turboprop, has something to offer in overall efficiency, but at this high speed, where the pure jet can be almost as efficient, its attractions are offset by its complications.

With particular reference to commercial application it may be remarked that, recently, there has been increased interest in turboprops, especially in America, because of the continued high fuel consumption of the simpler turbojet at the operational speeds and altitudes currently employed or foreseen for the next few years. Additionally, experiments with new types of airscrews for high subsonic and even sonic speeds, if they lead to satisfactory developments, must result in an accentuation of this trend. To date, airscrew efficiencies of 80-85 per cent up to a speed of 500 m.p.h. have been considered practical.

In America the few existing turboprops employ multi-stage (as many as seventeen) axial compressors, and frontal area has been kept down to a minimum.

When comparing turboprops with large piston-engines, the important effect of "vibrationless" operations upon the design and weight of airscrews and airframes and upon the serviceability of instruments and equipment should not be overlooked.

The first turboprop-powered aircraft to fly was the experimental Meteor I with two Rolls-Royce Trent units. The date was September, 1945, and the pilot was W/C. J. H. Heyworth. The Trent was a converted Derwent II turbojet fitted with a reduction gear and five-blade airscrew. Test of this hybrid unit commenced in May, 1944, and its power output was 750/800 s.h.p., plus 1,000 lb thrust.

Subsequently the Rolls-Royce company designed and developed two very different turboprops, the Clyde and the Dart. The former was the first of its class to obtain a full civil and military type-test certificate, and but for turbojet priorities in an already fully occupied organization it would certainly not have been shelved. An axial and a centrifugal compressor were employed. The Clyde developed 2,500 s.h.p. for its type test, and was subsequently approved for a 3,500 e.s.h.p. rating. The highest power developed with water/methanol injection was 4,500 e.s.h.p. With a 200-hour overhaul period as a start, an experimental installation was made in the Wyvern.

To-day the Dart is one of the most successful turboprop units in the world, and over several thousands of hours in the air has proved to be robust and reliable. It has a two-stage centrifugal compressor and develops 1,400 s.h.p. plus 295 lb thrust for take-off. The cowled diameter is 38.5in and the weight, less airscrew, 850 lb. Maximum cruising consumption under static S.L. conditions is 1 lb/e.s.h.p./hr. Various aircraft installations for flight development and operation are illustrated, most important among which are the Viscount 700 for B.E.A. and the experimental Dakota, one of two freighters for the same Corporation. In addition

First turboprop to fly was the Rolls-Royce Trent. In 1945 two Trents were installed experimentally in an early Meteor airframe to which more fin area had been added. The Editor of "Flight" was the pilot when this photograph was taken at Bitteswell Airfield, Leicestershire, in March, 1948.

DEVELOPMENT OF THE TURBOPROP . . .

to those illustrated on page 494 were the Dart-Lancaster five-engined test bed and an Athena trainer.

Two other companies in particular were also in the turboprop market at an early stage: Armstrong Siddeley with the Python and Mamba and Bristol with the Theseus.

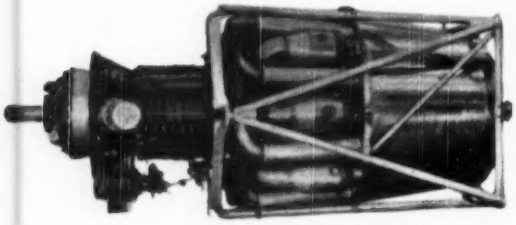
The axial-flow Mamba was fully type-tested in March, 1948, having first flown in October, 1947, in the nose of a Lancaster. Since then it has found several applications, as illustrated on the facing page. Its diameter, 29in (31in over cowling) is exceptionally small, and cruising fuel consumption (at 350 m.p.h. at 20,000ft) of 0.67 lb/e.s.h.p./hr is modest for a small turbine.

An earlier A.S. design, considerably larger and more powerful, is the Python, which in fully developed and type-tested form now powers the Navy's Westland Wyvern strike fighter. Python double-reverse-flow axial-compressor units were extensively air-tested (in substitution for the outboard Merlins) in a Lancaster before flying in the Wyvern. Both aircraft are illustrated. The Python develops 3,670 s.h.p. and 1,150 lb thrust static at sea level, and weighs 3,150 lb. The diameter is 54.5in and specific consumption 0.60 lb/e.s.h.p./hr.

Bristols first turboprop, the Theseus, embodied several original features, chief among which was the free-turbine arrangement whereby the compressor and airscrew were driven by two separate and mechanically independent turbines. The company also make use of an axial, followed by centrifugal, compressor arrangement, and in connection with the Theseus, made a study of the possibilities of incorporating a heat exchanger to retain a part of the heat energy normally exhausted. The Theseus is fully type-tested and has successfully completed some remarkably long endurance runs. It first flew in a Lincoln flying test-bed, and examples of Theseus-Lincolns have been operating experimentally with Transport Command for many months past to obtain operating experience.

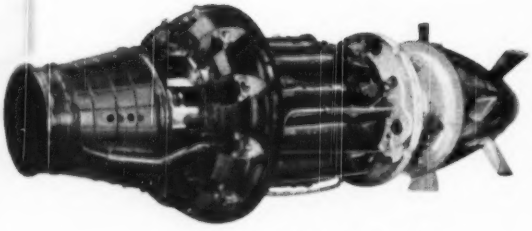
Most important Theseus installation is in the H.P. Hermes V airliner. Should this aircraft be ordered in quantity, petal-cowled Theseus power plants will probably go into small-scale production; otherwise the company is expected to concentrate on the later Proteus. The Theseus 502 gives 2,220 s.h.p. and 825 lb thrust for S.L. take-off, and has a specific consumption of 0.773 lb/e.s.h.p./hr. The weight, with mounting and torquemeter, is 2,205 lb, and the diameter is 54in overall.

In addition to the Mamba and Dart, there is a third



Bristol Theseus.

Handley Page Hermes V airliner powered by four Bristol Theseus.

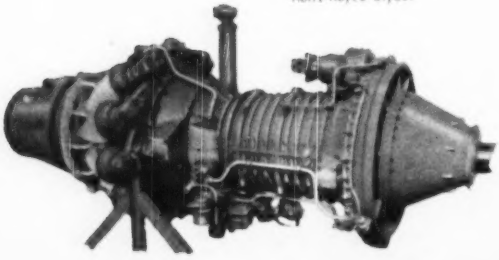


Armstrong Siddeley Python.

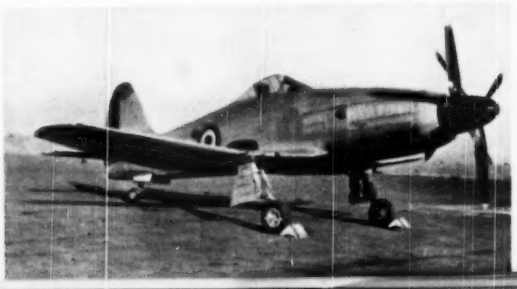
"Flight" photograph

Westland Wyvern naval strike aircraft powered with a Python.

Rolls-Royce Clyde.



A prototype Wyvern with Clyde turboprop installed.



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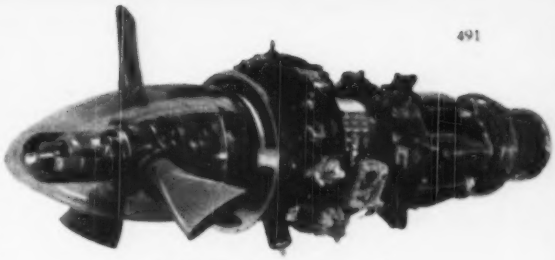
small turboprop known as the Naiad, designed, developed and flight-tested by the Napier Company. This is of very small diameter (28in) and is characterized by a neat ducted spinner for its airscrew and air intake. The Naiad gives 1,500 s.h.p. and 240 lb thrust for a weight of 1,095 lb.

In passing, it may be mentioned that an interesting slim axial turboprop in the 1,500 s.h.p. class was designed by Sir Roy Fedden in 1946 and named the Cotswold. Components were assembled, but the country's serious financial position led to the cancellation of the development contract.

One of the latest turboprops in this country—of which much is expected—is the Bristol Proteus. Now under flight development in a Lincoln test-bed, the Proteus is destined for the Bristol 175 airliner. It delivers 3,200 h.p. and 800 lb static thrust at sea level. Weight and diameter are respectively 3,050 lb and 38.5in, while specific consumption has already been brought down to a figure of 0.51 lb/e.s.h.p./hr. The Proteus has a three-stage turbine of the "free" type, the first two stages, driving the compressor, having no mechanical coupling with the third for the airscrew. As with the Python, the airflow undergoes two reversals within the engine, the final turn-round into the combustion chambers being achieved in passage through the stage of centrifugal compression.

Coupled pairs of Proteus are to power the two largest British aircraft, the Bristol Type 167 Mk II, of which the Brabazon is the prototype, and the Saunders-Roe Princess.

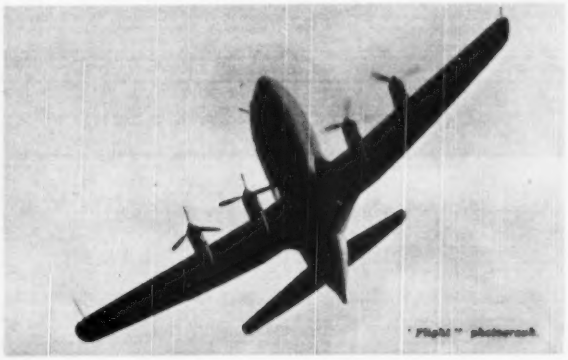
Quite a number of turboprops are now being produced in either coupled or in doubled form with two separate turbine units driving either a contraprop or co-axial airscrews through a common gear box. This course has been adopted in preference to the use of one much larger turbo-



Armstrong Siddeley Mamba (military version).

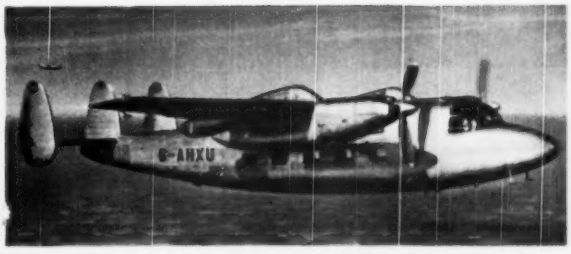
prop for several reasons. In the first place it is not so easy to scale up a turbine unit as had originally been thought. Mechanical design problems, bearing sizes and loads, and stiffness of casings and diaphragms are examples of possible sources of complication. Again, there is the problem of production space and multiplication of components, and the all-important time and manpower considerations involved in a new design. It has been found that often it is preferable to double or couple existing units to obtain greater power output. Additional advantages of this arrangement are the cleaner wing with less area swept by slipstream, less interference with structure, and reduced asymmetric effect in the event of an engine failure. Possible disadvantages which come to mind are the small additional complication and weight, and the risk that, in the case of the double unit, a serious mechanical fault in one airscrew or its drive may result in damage to the other and conse-

(*Continued on page* 494)

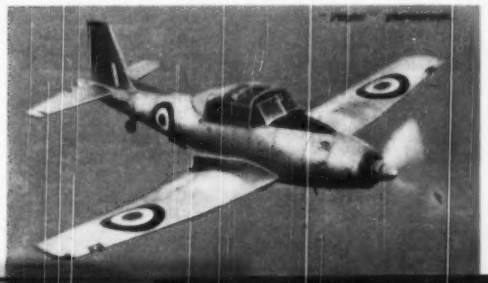


"Flight" photograph

"Flight" photograph



Many and varied are the aircraft which have flown with the power of the compact little Mamba. Top, left, is the Armstrong Whitworth Apollo airliner, and beside it the experimental Mamba-Dakota. Above, left, is the Mamba-Marathon experimental feederliner and alongside it a prototype Avro Athena advanced trainer. Below are seen (left) the Boulton Paul Balliol I, and (right) the newly announced Short S.B.3 anti-submarine aircraft.



"Flight" photograph

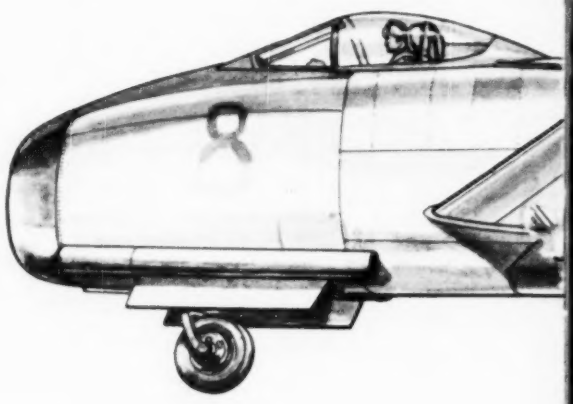
DURING the war years the scarcity of information on the newest enemy aircraft was the cause of much spurious material—descriptive and pictorial—finding its way into print. Not only was this an embarrassment to those responsible for disseminating authentic data, but on occasions it proved a veritable menace.

In post-war years a similar state of affairs has arisen in respect of Soviet aircraft and, while some smart amateur intelligence work has been noted, especially in this country, its value has been largely nullified by dilution (or pollution) with strongly suspect, or patently incorrect, effusions.

The most positive information on new Soviet aircraft is that based upon photographic evidence, before "interpretation" by "experts." But this virgin material is extremely rare and, rather than starve our readers of interesting, if not wholly authenticated, news of Soviet developments, we have occasionally offered the cream of the "second-hand" information which has come our way.

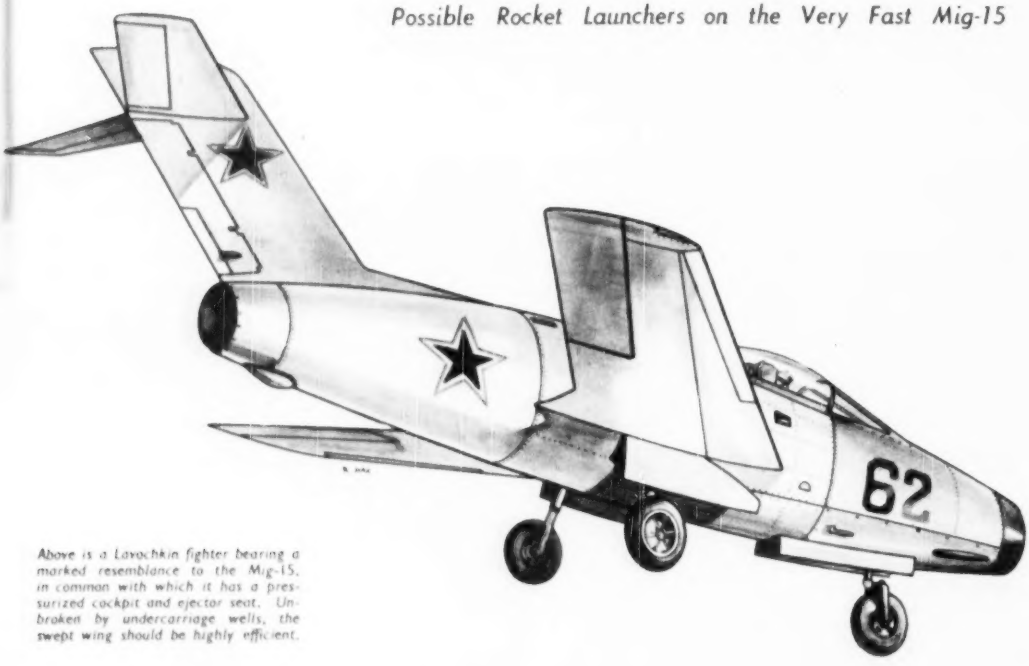
Thus, on these pages we present four drawings by a Dutch artist purporting to show four types of Soviet fighter. Those depicting the Mig-9 and Mig-15 are believed to be dependable representations of their subjects and include more detail than is common in such reconstructions. The drawing of the Lavochkin is technically less reliable, and that of the alleged twin-jet all-weather type is definitely suspect. The complete set, however, does betoken the formidable nature of the newest Soviet fighters, and it may be remarked that the performance of the Mig-15, deduced from earlier published impressions, seems to have been substantiated by reports of very high speeds attained by this type in combat with Shooting Stars and Panthers in Korea.

The Mig-15, with rocket-launching tubes—believed to be automatically loaded—attached low on the fuselage nose-section. Speed probably exceeds 650 m.p.h. by a comfortable margin.

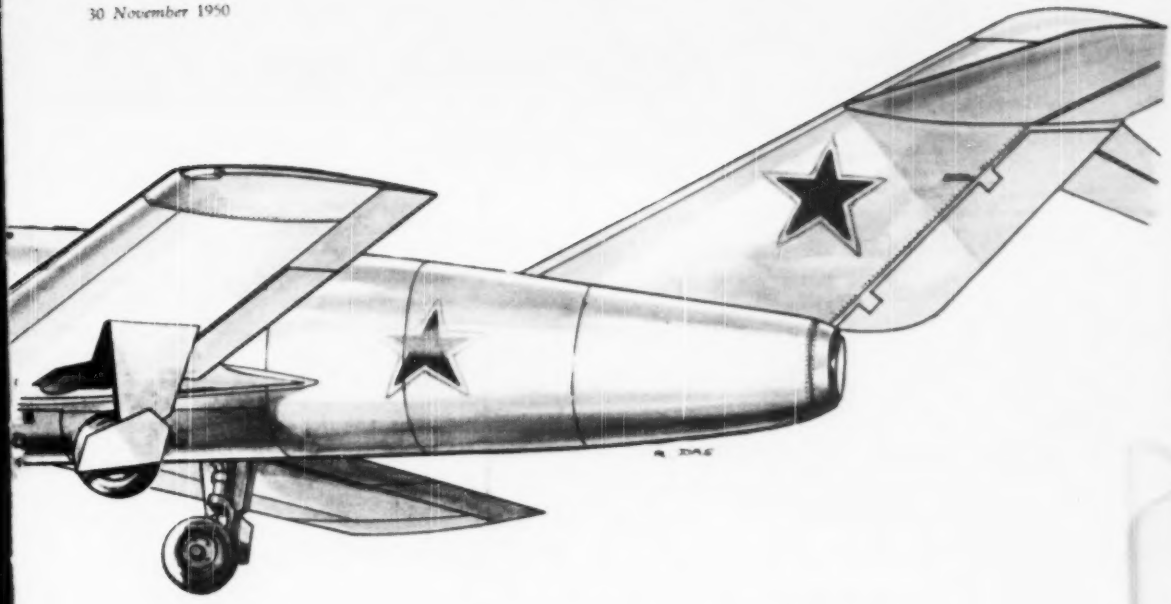


SOVIET FIGHTERS

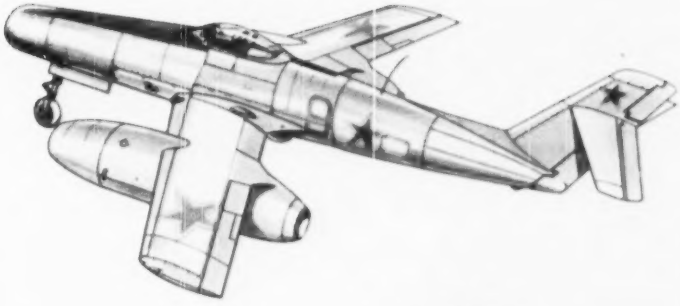
Bold and Distinctive Design Characterises Four Types: Possible Rocket Launchers on the Very Fast Mig-15

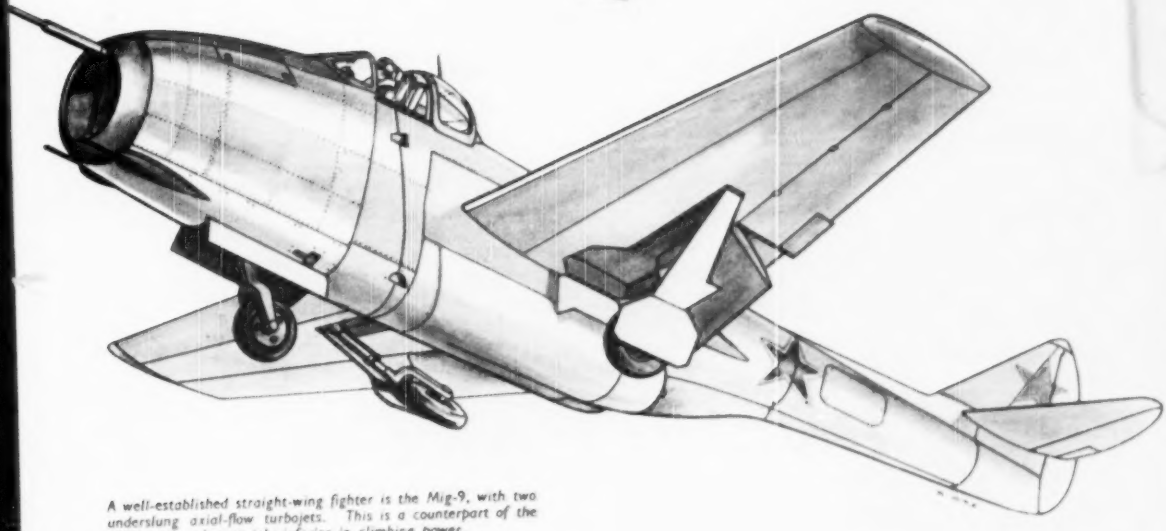


Above is a Lavochkin fighter bearing a marked resemblance to the Mig-15, in common with which it has a pressurized cockpit and ejector seat. Unbroken by undercarriage wells, the swept wing should be highly efficient.

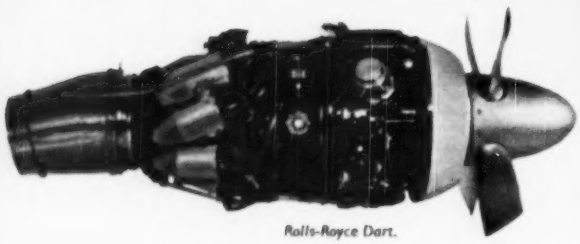


The twin-jet machine on the right is described as a Lavochkin all-weather fighter. Earlier sketches depicted a straight-wing version of a similar type, likewise a single-seater.

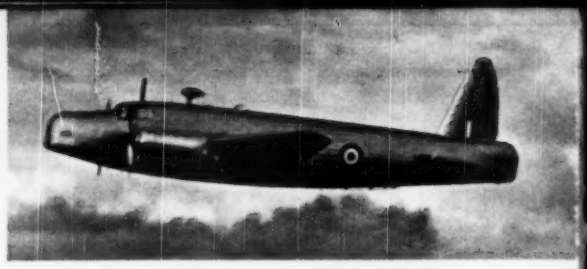




A well-established straight-wing fighter is the Mig-9, with two underslung axial-flow turbojets. This is a counterpart of the Meteor, though certainly inferior in climbing power.



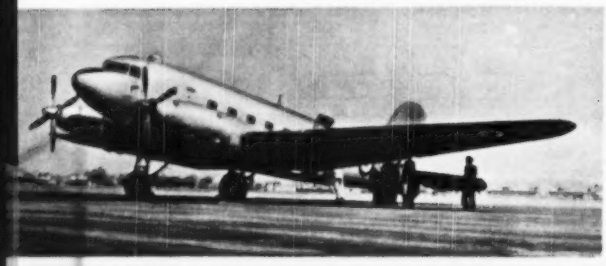
Rolls-Royce Dart.



Early experimental installation of two Darts in a Wellington test bed.

DEVELOPMENT OF THE TURBOPROP . . .

(Continued from page 491)

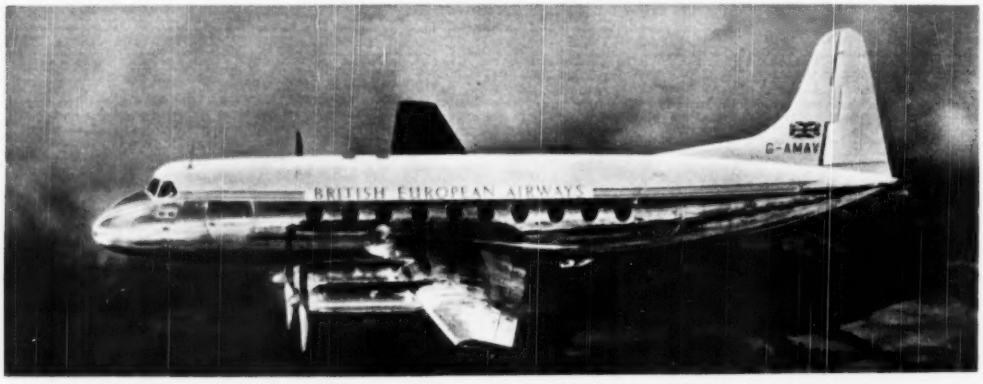


Two Darts are installed in this experimental Dakota. Two such freighters are to be tried out by B.E.A. on its internal routes.

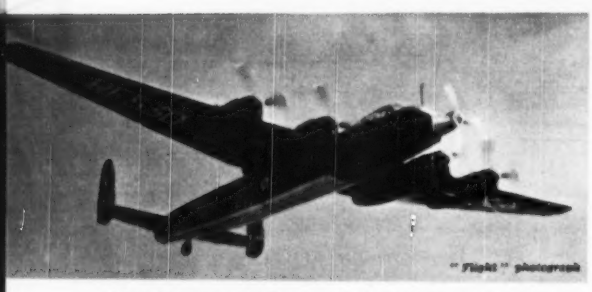
quently a double power-failure. Apparently, in view of current Naval aircraft designs, to be referred to below, this risk is not rated very highly.

Perhaps it should be explained that in a coupled unit such as the Proteus both units drive the contra-gearbox, through a single common shaft, and in the event of a failure of one, the other drives both blade banks of the contraprop. The inoperative turbine must be isolated mechanically by means of a clutch or free wheel. With a "Siamese-twin" unit such as the Double Mamba, each unit drives one of the contra-rotating co-axial airscrews quite independently, although the gear trains are in a common casing. If either unit fails one airscrew is feathered and the other continues to operate under the power of one Mamba. This constitutes one of the main differences between the power installations of the Brabazon and the Type 167 Mk II. The Centaurus piston engines of the Prototype are arranged as double units operating quite separately but mounted in pairs. The Proteus pairs are, on the other hand, coupled.

The coupled Proteus has run on the beds but has not yet been tested in the air. Flight testing will most probably be carried out in the actual aircraft for which the units were designed. Power output is exactly double that of the single Proteus. To disengage one unit a hydraulically operated dog clutch is fitted between its turbine shaft and main driving pinion.



Outstanding among turboprop designs is the handsome Viscount 700 airliner powered with four Rolls-Royce Darts.

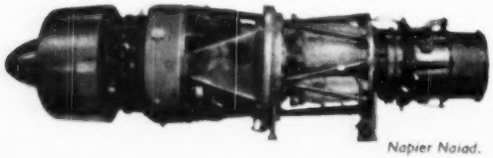


A Lincoln serves as the flying test-bed for the Napier Naiad in its nose.

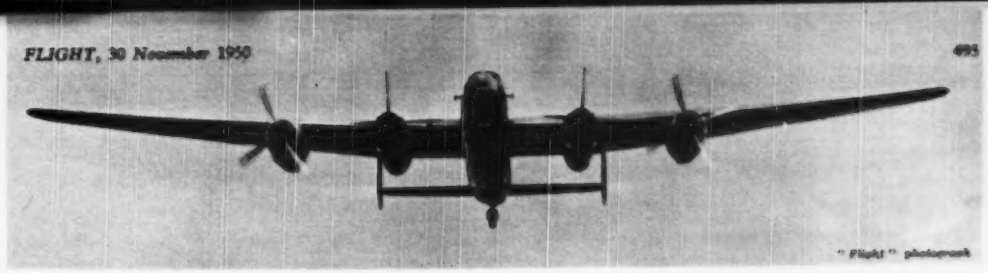
Latest addition to Armstrong Siddeley's turboprops is the Double Mamba, which powers the Blackburn and Fairey anti-submarine machines. These aircraft cruise economically with either one of their Mambas stopped and its airscrew feathered. The weight of the double unit is 2,000 lb and its combined take-off rating 2,040 s.h.p. plus 810 lb thrust.

Still in its experimental stages and at present set aside to allow its designers to concentrate on other types of units, is the Napier Coupled Naiad. It produces 2,970 s.h.p. and 480 lb thrust for a weight of 2,550 lb. Twin free-wheel mechanisms are incorporated in the duplex two-stage reduction gear.

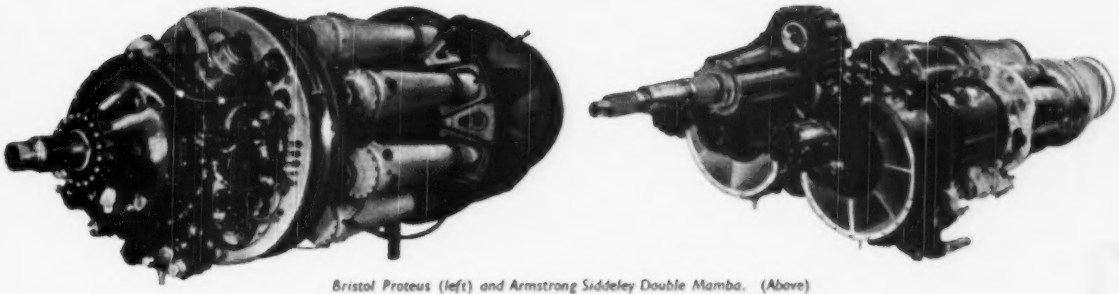
In America, justifiable pride in the latest piston engines, together with well-filled order books and a firm belief in various arrangements of exhaust turbo-superchargers upon



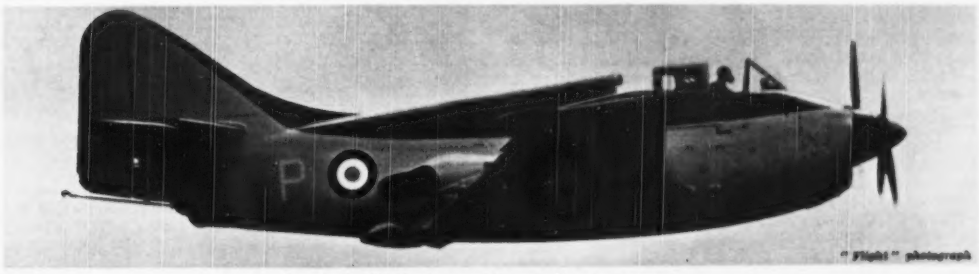
Napier Naiad.



"Flight" photograph



Bristol Proteus (left) and Armstrong Siddeley Double Mamba. (Above) A Lincoln test-bed flying on the power of its two outboard Proteus. Note the relative diameters of the Merlin piston engines and the turboprops.

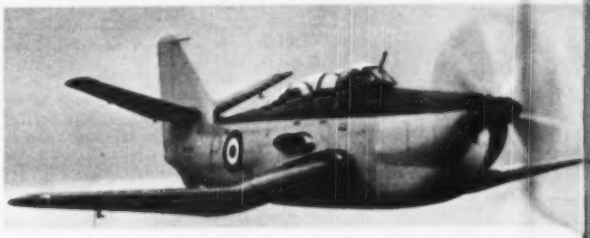


"Flight" photograph

Fairey's Double-Mamba-powered anti-submarine prototype.

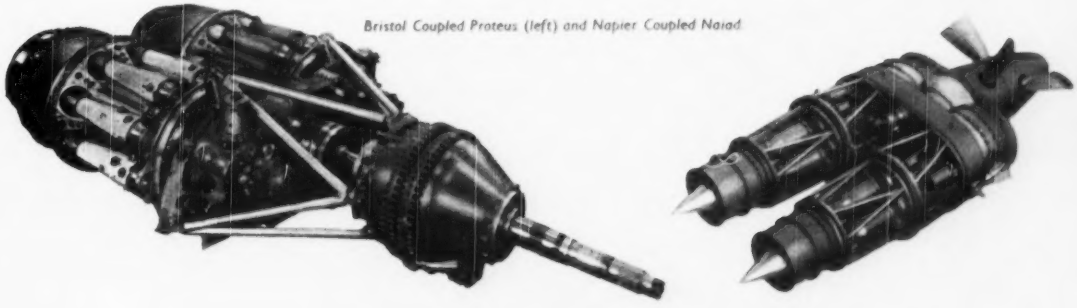
which much time and effort has been lavished, has resulted in slow progress and a rather lukewarm interest in turboprops. More recently the position has shown definite signs of changing, and at least two very promising units are now on test. Even at this early stage in their development figures have been announced—particularly for fuel consumption—which, if realized in operation, will guarantee an important future for these turbines. All are axial-flow designs of small diameter and considerable length. Conversion of existing pressurized airliners to turboprop power is under discussion, and in one instance the work is in hand.

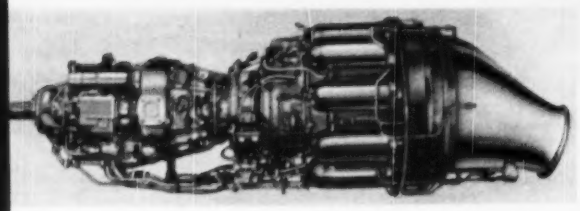
First American turboprop to be built was the bulky General Electric TG-100 (or T-31) developing, when installed in the "pull-push" Consolidated-Vultee XP-81



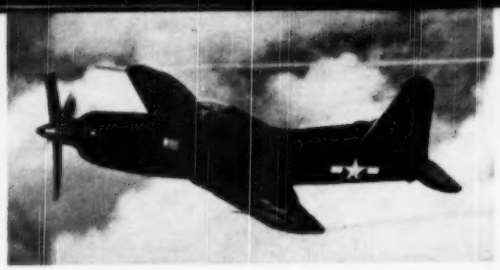
Blackburn's anti-submarine aircraft, also Double-Mamba-powered.

Bristol Coupled Proteus (left) and Napier Coupled Naiad





General Electric TG-100.



Ryan's XF2R-1 Navy fighter with TG-100 and jet power.

DEVELOPMENT OF THE TURBOPROP . . .

illustrated, 2,200 s.h.p. and 600 lb thrust. A model TG-110 and a double version, the TG-120, were dropped in 1947. A Ryan Fireball development for the U.S. Navy, known as the XFR-1, was the next to fly with the power of a TG-100.

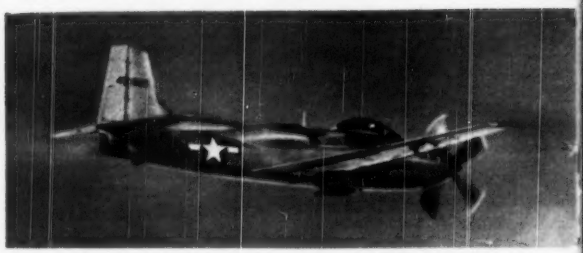
Already running at that time was the first Boeing lightweight turboprop Model 502, forerunner of the unit which was recently installed and demonstrated in a lorry, and which may soon be seen in a light aircraft (there is a proposal for a Luscombe type T-8G-8 in addition to a conversion of one of Boeing's own YL-15s), a helicopter, and in marine landing-craft. Roughly speaking, its potentialities may be compared with those of the British Rover Car Company's small unit. Incidentally, the Bristol Janus may be named as one of three or more other designs of under 500 s.h.p. output which have been studied or actually built.

Among the first turboprops to be announced in America was the Northrop-Hendy Turbodyne, running under development at the time as a pure jet. A unit was said to have been completed in 1945, and a power figure of 2,400 s.h.p. was quoted, but after providing some experience it was allowed to fade out. A newly constituted company, the Turbodyne Corporation, is now believed to be well advanced upon a Service contract which includes the building and development of the new large XT-37 turboprop in the 10,000 s.h.p. class. It is to be suitable for pusher or tractor installation and is illustrated here on the test bed at Hawthorne, California.

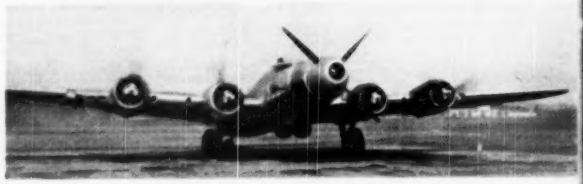
The Wright Aeronautical Corporation has had a turboprop of its own design, the XT-35, flying since 1947. It is in the 5,000 s.h.p. class, and for air test is installed in the nose of a B-17. In addition, the company took over the development of the much-handed-round XJ-37, alias Lockheed (1945), alias Menasco L-4000 (1946). The basic unit is intended for adaptation to either turbojet or turboprop duties. As a turbojet it is rated at 5,000 lb thrust.

It has recently been announced that an agreement has been negotiated between Wright and Armstrong Siddeley to permit the building under licence of the Mamba, Double Mamba and Python, in addition to the Sapphire turbojet, and another with the Bristol Aeroplane Company for a particular gas turbine, unnamed over here but said by certain American sources to be called the Olympus.

Pratt and Whitney, who are well known in the piston-engine and turbojet fields, and who hold the licence to build the Rolls-Royce Nene and Tay, recently released a photograph and some details of a remarkable new turboprop of their own design and sponsored by the U.S. Navy. Known as the Turbo-Wasp T-34, and now undergoing flight development in the nose of a B-17, this unit is able to develop a maximum of 6,000 s.h.p. and on a 50-hour preflight test established a preliminary rating of 5,700 s.h.p.



Composite-powered Consolidated-Vultee XP-81 with TG-100 installed in the nose and I-40 turbojet in the tail.



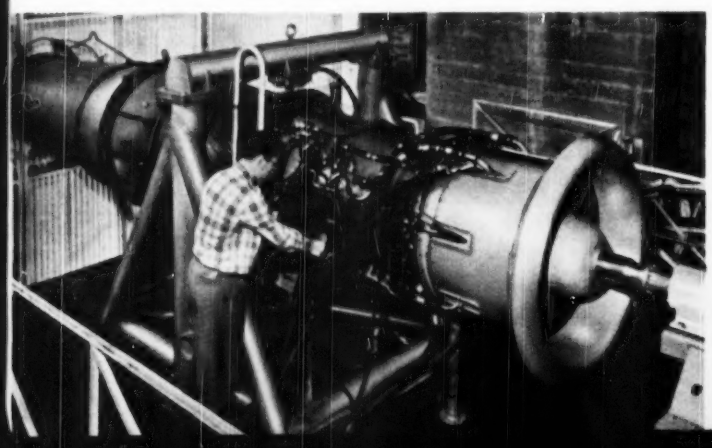
A B-17 five-engined flying test-bed with Wright XT-35 Typhoon turboprop in the nose.

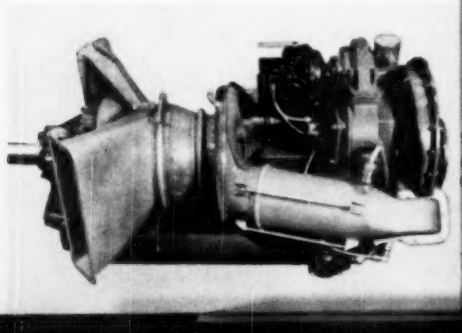
Work started on the T-34 in June, 1945, and flight testing began last August, by which time more than 1,400 hours of test-bed running had been completed by whole power units.

Described as a high-pressure axial-flow unit, the T-34 has a 13-stage compressor, annular combustion chamber and three-stage turbine. A two-stage reduction gear of 11 : 1 ratio is employed and the coupling between this and the compressor shaft is of the flexible type. Between the turbine and compressor there is a rigid coupling.

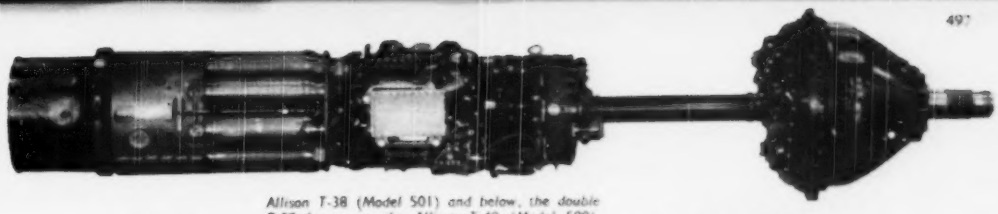
A special high-speed airscrew is being developed for the T-34 which will incorporate a brake to prevent windmilling. The single-lever power control for fuel and airscrew pitch is described as of the mechanical type.

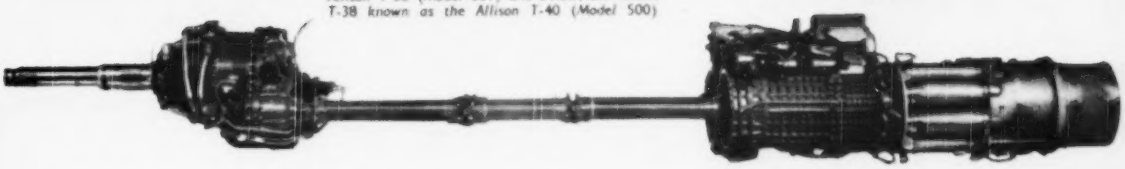
Stainless steel is used almost exclusively in the construction of the T-34, but the power-to-weight ratio is high at





(Left) The Turbodyne Corporation's 10,000 h.p. XT-37. (Below) Boeing's Model 502 turboprop. (Right) Pratt and Whitney T-34 Turbo-Wasp.





Allison T-38 (Model 501) and below, the double T-38 known as the Allison T-40 (Model 500)

over 2 s.h.p. per pound of weight. About 90 per cent of the total power output is delivered to the airscrew shaft. Thermal de-icing for the main intake is accomplished by bleeding air from the unit.

Dimensions and weight are, respectively: length, 155in; basic diameter, 30in weight, 2,550 lb. The specific consumption is 0.62 lb/s.h.p./hr.

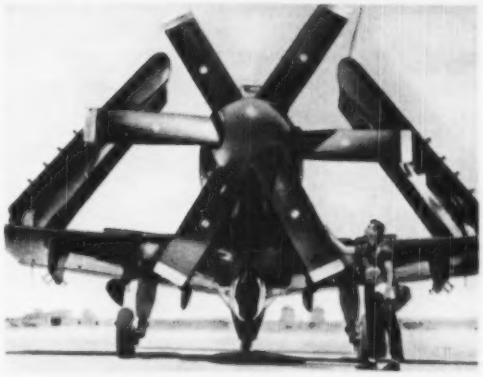
A good deal has been heard during the year about the promising Allison turboprop, the T-38—also U.S. Navy sponsored—and of its double version, the T-40 (Allison Model 500). Both units have very high power ratings for their weight—more than 2 b.h.p. per lb—and the basic engine is a slim design with 17-stage axial compressor (giving a 6.3 : 1 compression ration) and eight cylindrical combustion chambers. On both the T-38 and T-40, extension shafts link the turbine and gear box. Pneumatic starters are fitted. Figures released include a power rating of 2,750 s.h.p., a diameter of 20in, and a weight of 1,225 lb for the T-38 and double in each case for the T-40. Specific fuel consumption is quoted as 0.63 lb/b.h.p./hr and the makers say they expect to reduce the figure to 0.58. The length of the basic power unit is 7ft.

Test-bed running of the T-38 power section began in January, 1948, and rated power was developed by June. Flight testing was started early in 1949 in a B-17. The T-40 first run in June, 1948.

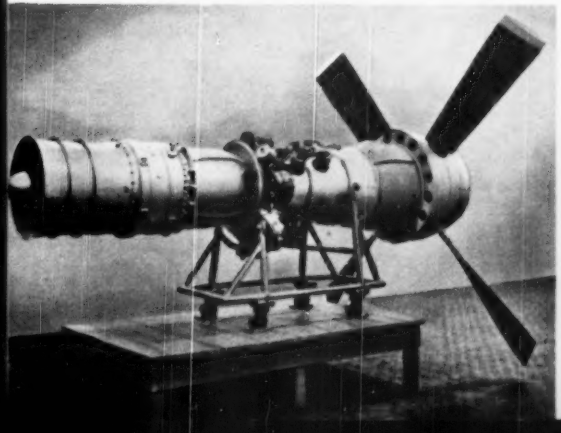
Examples of the T-40 double unit are now flying in the new Convair XP5Y-1 naval flying boat (four T-40s), and in the Douglas Skyshark is buried a single T-40. Two T-38s are soon to fly in a modified Convair-Liner to be used for research and demonstration to civil operators.

As we close for press comes news of a Boeing Airplane Company project for a feederliner—the Model 498-4—with two Rolls-Royce Darts or two Allison T-38s.

Although this review is primarily concerned with British and American turboprops it is of interest to record here that France has produced three designs worthy of mention, all of which were shown at the Paris Exhibition of May, 1949. One, the S.O.C.E.M.A. T.G.A-1 Bis, is a twelve-stage axial-flow unit with four turbine stages and developing some 2,000 s.h.p. Another, designed by S.N.E.C.M.A., is known as the TB.1000. This has nine stages of compression and develops about 1,300 s.h.p. These units have not flown. Finally, there is the very small Turboméca design called the Orédon, which produces 140 s.h.p. and weighs only 185 lb.



T-40-powered Douglas XA2D-1 Skyshark.



Convair XP5Y-1 with four T-40s of the type illustrated above. (Below) A B-17 flying test-bed with Pratt and Whitney T-34 in the nose.

Design and Purpose

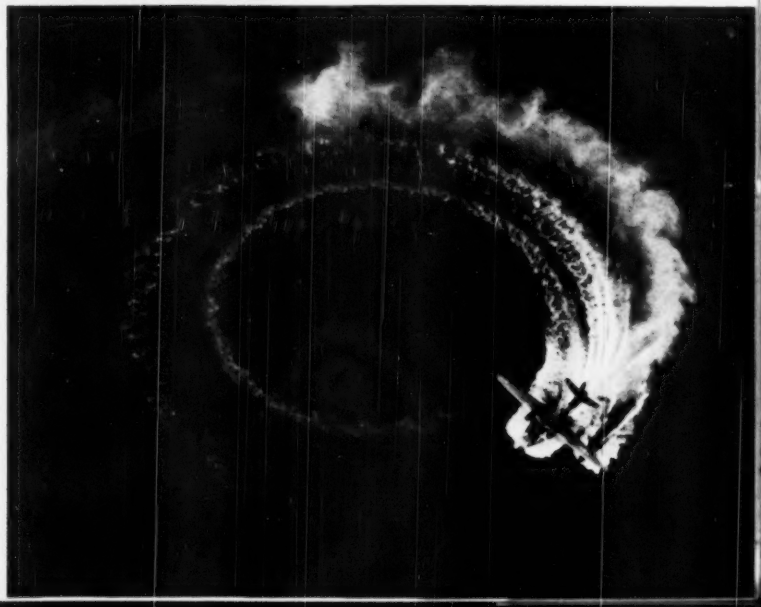
(Above) A Douglas B-26 disgorges a bomb above a makeshift Korean bridge. The retarding parachute is seen filling. Rockets remain unfired.

Photograph by Life International. Copyright Time Inc., 1951

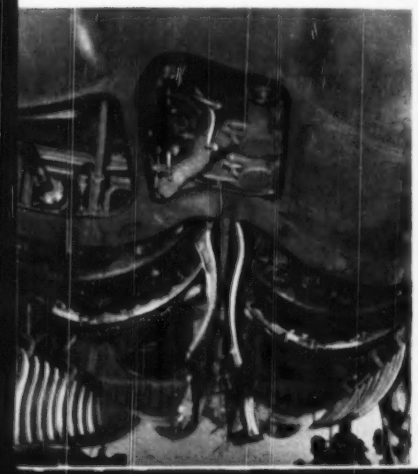
(Left) Inspired gift from "The Throttle-Benders' Union" to Col. R. L. Preston, secretary general, Royal Aero Club. Each glass carries the signature of a racing pilot and a painting of his aircraft. Left to right: Alington (Sparrowhawk), Somers (Gemini), Dunkerly (Gemini), Cole (Swift), Rush (Falcon Six), Paine (Hawk Speed Six.)

"Flight" photograph

(Below) Martin Marlin prototype demonstrates short turning-radius achieved with its "hydroflap" (under-water rudder and brake) installation.



(Below) Exposed for rarely needed attention are two of the de Havilland Comet's four Ghost turbojets, each of 5,000 lb thrust.

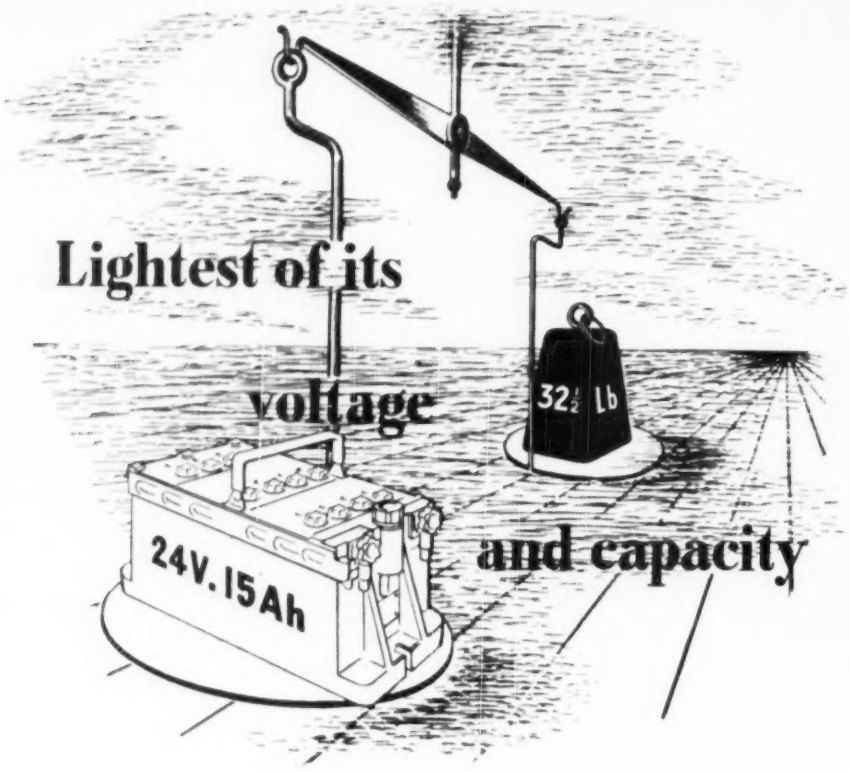


The PRESTWICK PIONEER powered by the Alvis Leonides engine

ALVIS

LEONIDES

ALVIS LIMITED, COVENTRY, ENGLAND



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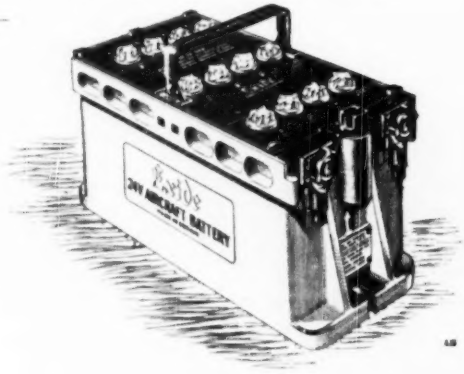

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CIVIL AVIATION NEWS

HOME-GROWN : Swedish-built Scandias will soon be introduced on medium-length routes in the S.A.S. network. The first aircraft, seen here, is already serving as a training unit for crews and ground personnel ; the remainder are scheduled for delivery next April.

B.O.A.C. SALES DRIVE

AN encouraging indication that the Corporations are now realizing the importance of airline "salesmanship" is seen in the fact that B.O.A.C. has just organized its first world-wide sales conference, attended by some 36 area and sales managers from the overseas bases.

Welcoming the delegates to the conference, which opened in London on November 20th under the chairmanship of Mr. Keith Granville, general manager, sales and traffic, Sir Miles Thomas said: "We stand to-day in a position of realistic optimism. . . . We have new equipment and a streamlined organization and we have established a ratio of personnel and equipment on about the right lines. We should thus be able to go forward and compete with our contemporaries on at least level terms. . . . We are selling something of good value to the public—fast, comfortable and competitive air travel . . . an increasingly aggressive sales attack by all concerned from this moment will, I am sure, bring results that will show continuing improvement."

Flight is particularly glad to see that British operators are getting down to the roots of the problem of selling an airline ticket—a gentle art which for too long has seemed to be more or less the monopoly of our American friends and—to a lesser degree—of some European operators who have been rather quicker "to see the light" than we in Britain.

Following, as it does, the historic event last month when, for the first time, the Corporation made a profit on its operating account over all routes, this latest conference would seem to foreshadow the beginning of a much happier trend in B.O.A.C.'s operating results.

TUDOR ACCIDENT FINDINGS

THE M.C.A. has now published the findings of the Court Investigation into the cause of the accident to Tudor G-AKBY, owned by Fairflight, Ltd., which occurred near Llandow, Glam, on March 12th. We record the views and findings of the Court without comment.

The Court, conducted by Sir William McNair, K.C., assisted by two assessors, reached the conclusion that the most probable cause of the accident was to be found in the loading conditions of the aircraft, which gave a c.g. position considerably aft of that authorized in the C. of A. This resulted in insufficient elevator control remaining when the pilot applied full power at a speed which, though well above the stalling point, was sufficiently low to cause serious instability.

It was clearly established, the report states, that with the full permissible load of passengers, an acceptable c.g. position could have been secured only by the stowage of more than a ton of luggage or ballast in the main front cabin. Nowhere in the statutory regulations to which the Court's attention was called, continues the report, was there any provision dealing with the weight of passengers' luggage or ballast.

The report also criticizes the loading instructions for use with this particular type of aircraft. The present scheme contains, it says, no adequate directions for the calculation of the "mean passenger arm" in the various arrangements of seating required in charter operations—a system which seems to throw an unduly heavy burden of responsibility upon the pilot.

The investigators recommend that, where seating arrangements are changed, a new Daily Certificate and Technical Log should be prepared, in which it should be the duty of the maintenance engineer making the alterations to record for the information of the pilot the distance of the new positions from the datum.

The Court also felt it necessary to state that so long as any latitude was permitted in the observance of Article 16 (5) (1) of the Air Navigation Order 1949 (which prohibits the flying of any aircraft "unless the operator has obtained the approval of the Ministry to written loading instructions in respect of that aircraft") it was natural that there should be a tendency towards laxity in the observance of the other provisions of the order relating to load-sheets and general load disposition.

The Court dismissed as being "inherently improbable" A.V.-M. D. C. T. Bennett's suggestion that the accident may have been caused by the pilot involuntarily pulling back on the control column as a result of his seat slipping.

Following the publication of the findings, A.V.-M. Bennett said in a statement that, in his opinion, the c.g. was certainly within the limits and that, in view of the wording of the Air Navigation Order, it seemed strange to say that the load-sheet was incorrect when no proof was submitted to the contrary.

It will be recalled that on November 22nd, Fairflight, Ltd., were fined £50, with £150 costs, for having incorrectly loaded the Tudor. Notice of appeal was subsequently lodged.

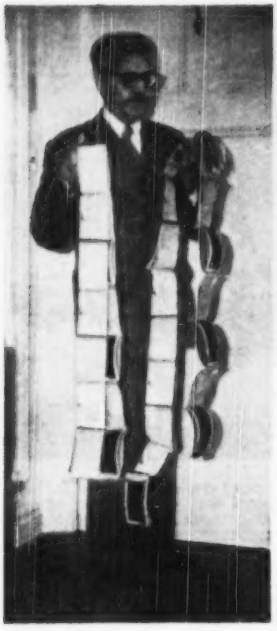
B.E.A.'s GOOD SEASON

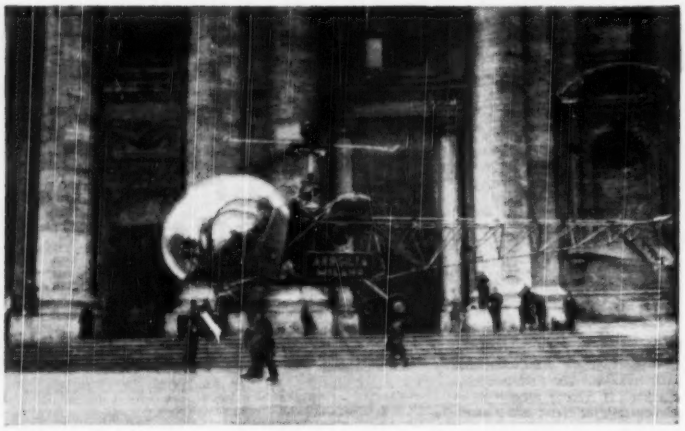
ALTHOUGH B.E.A.'s safety record this year has been marred by the two tragic accidents in October, the Corporation has good cause to be proud of its commercial achievements this summer. Profits during the summer months were: June, £9,145; July, £116,774; August, £134,871, and September, £124,828. During the peak month, August, B.E.A. carried 130,212 passengers—more than 4,200 a day—flew a record total of 15,766 hr, and earned £1,029,772 in revenue. For the first five months of the current financial year an operating profit of £136,783 was realized, as compared with a loss of £172,358 for the previous year. The September result has brought the moving annual total deficit to less than a million pounds.

During August, the highest revenue-earning route was that from London to Paris, which produced nearly £138,000, followed by the London-Athens-Istanbul route, which brought in some £92,000. The month's highest load factor was that on the London to Channel Islands services (75 per cent), while another encouraging feature was the steady growth of freight traffic on Mediterranean routes.

Writing in the current issue of the *B.E.A. Magazine*, the chief executive, Mr. Peter Masefield, points out that expenditure has risen by 20 per cent (£600,000) above that of the first five months of the previous financial year, although 33 per cent more flying was done. He also emphasizes that the Corporation has to face some heavy future expenditure in the construction of the new maintenance base at London Airport and the introduction of Elizabethan-class aircraft (Ambassadors).

He considers that B.E.A. is now approaching the maximum





AVIATION ODDITIES : (Left) The world's longest—and, at £1,500, most expensive—airline ticket has been purchased by a Mr. Attullah Durrani, who plans to visit 60 cities on a business trip. (Above) An unusual sight for Italians was the landing of a Bell helicopter in St. Peter's Square, Rome : the pilot carried a message for the Pope.

CIVIL AVIATION NEWS . . .

possible figure for revenue which can be earned with the present fleet and that any big step forward must await the introduction of the Elizabethan and Pionair classes (DC-3s). The maintenance base for the Elizabethans and, later, for the Discovery class (Viscounts) will entail a capital outlay of about £1,750,000. This, however, will be spread over a nominal life for the buildings of some 50 or 60 years. The standing charges for the Elizabethans, which are assumed to have a ten-year life, works out at about £35,000 per aircraft per year.

On the question of how long B.E.A. will continue to fly from Northolt, Mr. Masefield says that there can be no question of a complete move before 1954, and that "it may well be quite a bit later." Elizabethan services will begin from London Airport in 1951 with those of the Discovery class following in 1953. Viking operations will continue from Northolt until the Discovery-class aircraft are progressively introduced. Pionair services to the Channel Islands are due to begin from Gatwick in 1952.

Mr. Masefield recently told the Welsh Advisory Council for Civil Aviation that he thought the British people were "beginning to have an air outlook," and that B.E.A. were looking to the day when summer profits would outweigh winter losses.

BREVITIES

INITIAL estimates of the American airline industry's profits for this year run as high as $50,000,000 (£17,900,000)—more than double last year's figure. Forty per cent of the 983 aircraft now being operated are of the four-engined variety.

* * *

Canadian Pacific Airlines has been given permission to fly a New Zealand-Australia sector as part of its Pacific service from Vancouver. Previously T.E.A. held the monopoly of this route. Initial frequency will be once a fortnight, and Canadair IVs will be used until Jetliners become available.

* * *

Announcing results for its 30th year of operation, K.L.M. reports a net deficit of 2,487,582 guilders (approximately £233,800). This figure was arrived at after the Dutch Government had granted the company 37,200,000 guilders (£3,497,100) to meet losses which were attributed mainly to the difficulties experienced on the Amsterdam-Jakarta service, due to the war in Indonesia, and to the devaluation of the guilder last September.

* * *

Three noted French wine and spirit producers, the houses of Ayala, Croizet and Rocher, which together welcomed many air visitors from Britain during the summer months, have jointly produced a gay little booklet entitled *Let's Have a Party*. Intended to help readers obtain the full measure of enjoyment from their Christmas festivities, the booklet is free and may be obtained from Blumenthals, Ltd., 125, Pall Mall, London, S.W.1.

* * *

The Columbian national airline, Avianca, is to be the first company in the world to try out the Whiting Lodair system for loading freight on to airliners. It will be installed at the Soledad airport, Barranquilla. By its use the aircraft is hauled to a freight dock by underground cables and winched into position with its main cargo door against the loading ramp. Advantages are claimed to be the possibility of using fixed loading facilities, and decreases in handling time and freight-handling costs.

The Egyptian airline S.A.I.D.E. has re-started operations on the Cairo-Tunis route with stops at Benghazi and Tripoli. Three-engined Fiat G-212s are used and permanent operation of this service is contemplated.

* * *

A preliminary report on Canadian civil aviation during 1949 shows that scheduled carriers earned operating revenues totalling $34,566,124, as compared with $28,500,903 in the previous year. Canadian commercial aircraft flew a total of almost 36,000,000 revenue miles and carried over 1,200,000 passengers last year.

* * *

Q.E.A.'s annual report, presented recently to the Australian Parliament in Canberra, shows that the company enjoyed a profit of £234,000 for operations in 1949. This was £100,000 more than the profit for the previous year; it enabled a dividend of 5 per cent to be paid to the Australian Government. Passenger mileage increased by 25 per cent and revenue by 20 per cent.

* * *

During the first half of 1950 commercial aviation in Spain showed some signs of expansion. The State airline, Iberia, obtained two additional DC-4s, which permitted increased frequency on internal services and the inauguration of several new ones. The non-scheduled company, Aviacion y Comerico, obtained rights to fly a number of short hauls between Spain and North Africa on a scheduled basis. This is said to depend, however, on the future acquisition of three Bristol Freighters.

* * *

A drastic shortage of materials and spare parts for commercial aircraft in the United States has compelled the Aircraft Industries Association and the Air Transport Association to claim priority in the allocation of essential components. The C.A.B. is to handle requests concerning new aircraft, while the C.A.A. will suggest priorities for spare parts. Their recommendations will then be passed to the National Production Authority, which will announce its final decision. The manufacturers hope to obtain sufficient materials to clear an unprecedented backlog of orders for 158 new transport worth a total of £53,500,000.

CLUB and GLIDING NEWS

IN an attempt to reduce the high cost of private-aircraft ownership in these difficult days, the Royal Aero Club recently conducted a survey of the expenses incurred by owners who operate their aircraft in accordance with the R.Ae.C.'s own system of Maintenance Schedules, introduced in 1948. The principle of these schedules is that, instead of allowing small faults to accumulate until the annual C. of A. overhaul becomes due, the owner should arrange for a series of monthly checks, with additional engine inspections every ten hours; a six-monthly inspection (with an overriding maximum of 120 hr); a yearly inspection to coincide with the C. of A.; and, finally, a complete overhaul every three years on the lines of the former annual C. of A. overhaul. This more detailed examination should also be carried out if the aircraft has reached 500hr before the three years are up.

The main cost-reducing factor is, of course, that at the yearly inspection A.R.B. surveyors make due allowance for the fact that the aircraft has been regularly inspected and maintained according to R.Ae.C. schedules. The cost of the overhaul is thus reduced and at the same time a higher standard of airworthiness and, consequently, of safety, is attained.

The schedules are applicable to single-engined aircraft not exceeding 3,500 lb a.u.w., or a power-rating of 220 h.p., and also to the Miles Gemini which, by special arrangement, may also be maintained in accordance with this scheme. The schedules are fully approved by the A.R.B. and are intended solely for privately owned machines.

Some examples of the very reasonable figures recorded by private owners taking advantage of the scheme are: maintenance of an Auster Autocrat for one year, £20 18s, in addition to the £5 fee for renewal of C. of A. (this is an exceptional example); a Miles Gemini, £32 plus £11 A.R.B. fee; an Auster Arrow, £34 14s 6d plus £5 A.R.B. fee! and another Autocrat, £42 13s plus £5 A.R.B. fee.

The R.Ae.C. also quotes basic figures for the number of man-hours which in normal conditions should be needed for inspections of certain types of aircraft. Monthly inspections of Austers should take 3 hr, Messengers 4 hr, Proctors 5 hr and Geminis 5 hr. For six-monthly inspections these figures should be doubled, except in the case of the Proctor, which requires 14 hr.

The schedules may be employed only by firms having the Royal Aero Club's approval, which is given only on the recommendation of the A.R.B. after investigation of the staff qualifications and facilities of firms applying for approval.

* * *

THROUGH a shortage of flyable weather, the Airways Aero Club, based at Denham, was able to achieve a total of only 154 hr during September. One unlucky new member from the Scottish Division spent a whole week at the airfield and only managed to get in 2½ hr flying.

Six new members joined during the month and three others have now completed their Private Pilot's Licence examination. The club was recently visited by the M.C.A. in connection with the granting of approval for the P.P.L. course which reduces flying time required for this licence from 40 to 30 hr. It is hoped that the approval will be announced shortly.

The 17-year-old D.H. Dragon *Orcadian* is now available for the use of all members with "twin" experience. It will carry six passengers and a fair amount of baggage, and is offered at £3 15s per hour. Handling notes for this aircraft are being compiled and a four-channel radio will be installed within the next few weeks.

* * *

THE Kemsley Flying Trust is now prepared to assist suitable qualified Groups to purchase high-performance sailplanes; terms will be subject to negotiation and applications should be made to the B.G.A. Now that the new Slingsby 18-metre sailplane has flown—and, according to reports, shows promise of being superior to the Weihe—the Kemsley Trust offer may open new prospects for the manufacture and use of all-British high-performance machines.

Viscount Kemsley is giving a cocktail party at Londonderry House on December 4th, the 21st Anniversary of the B.G.A. The party, which is by invitation only, is to be followed by a dance which is open to all. Tickets, price 15s each, may be obtained direct from the B.G.A. at Londonderry House, 19, Park Lane, London, W.1.

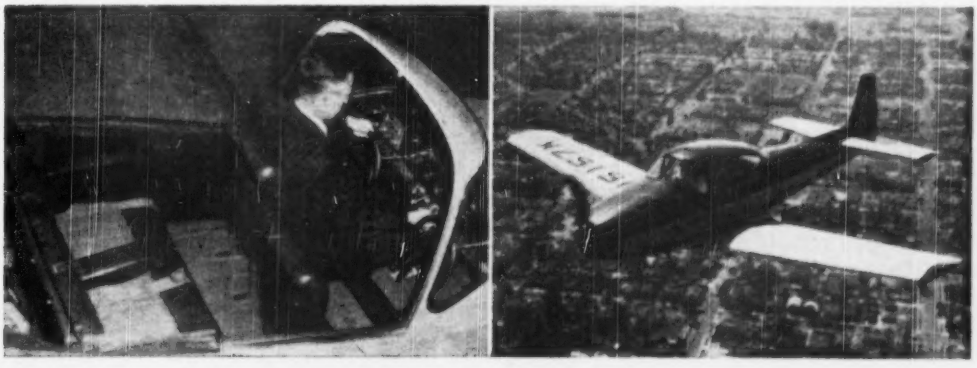
* * *

THE B.G.A. is now exploring the preliminary ground for next year's National Gliding Championships. It is understood that the Championships will involve more "task" flying than has been the case in the past, as it is considered that such competition provides a better opportunity of assessing the relative skill of contestants. The standard required of entrants is also likely to be higher. If all plans materialize, it seems likely that the 1951 National Championships will show a great advance over those held in the past, and it is to be hoped that a greater proportion of the competing machines will be entirely of British design and manufacture.

* * *

SLINGSBY'S new T.31 two-seater trainer has been undergoing extensive trials and is now available for purchase. It is a development of the Motor Tutor, which itself was a development of the Tutor Glider. The new T.31 has tandem seating and the wings are interchangeable with the normal Tutor fuselage and struts. Performance is understood to be very satisfactory for a machine of this type, and the manufacturer considers that the craft will form a very valuable addition to club fleets.

News of a high-performance two-seater was contained in a written answer in the House of Commons some time ago when it was said that an order was being placed for three high-performance machines to a design which won the Duke of Sutherland's prize competition in 1946. The Ministry of Supply and the Kemsley Flying Trust contributed £4,250 each to the project, and it is understood that work is now well in hand. It is hoped that the machine will be ready for the 1952 World Contests.



COCKPIT À LA MODE: The manufacturers' description of a 1951 Navion Super 260's exceptionally capacious cabin reads almost like a fashion editor's review: "Styled by Charles of California, . . . generous amounts of red, green and grey leather trim are used with soft but durable harmonizing fabrics." Together with this new sartorial elegance the 1951 model features an external door to the baggage compartment. As the flying view shows, this little aircraft retains the clean, sturdy appearance of its predecessor. A metal Hartzell airscrew is an innovation.

CIVIL AVIATION NEWS . . .

AIRLINE COMPETITION

Possible Trends in Peace and War : Dr. G. P. Baker's I.A.T.A. Lecture

IN *Flight* of November 16th we published a summary of Sir William Hildred's address before the annual general meeting of I.A.T.A., which took place in San Francisco last month. The assembly was also the occasion for the Annual I.A.T.A. Paper, delivered this year by Dr. George P. Baker, Professor of Transportation at Harvard University.

Entitled "Looking Ahead in International Transportation," the Paper dealt principally with the competitive aspects of international air transport.

Dr. Baker said that since he had discussed the subject of his lecture with Sir William Hildred some ten months previously, two factors had changed the burden of his talk. The first was the rather appalling and continuing lack of that data which should have been available before any attempt was made to dilate upon what future competitive relations among airlines would or should be. The second was the worsening of the international political situation. In the light of these factors, his remarks would, he said, consist of, first, a very general treatment of the problems of inter-line competition in a future peace-time situation which might be thought of as a continuation of the present post-World War II period; and, secondly, of an examination of competitive airline relationships in an all-out world war, or in a period of sporadic, but very active, local wars.

The speaker stressed the fact that his views were purely those of a Harvard Professor of Transport, and were in no way influenced by the fact that he had from time to time acted as a consultant to the U.S. State Department or was, in fact, at the moment, a U.S. representative on the United Nations Transport and Communications Commission.

It appeared, said Dr. Baker, that the most difficult competitive problem for the international airlines would be that of inter-line competition. A recent exhaustive study of the subject in the United States, based upon data from American domestic scheduled airlines from 1939 to 1949, was of great interest. He believed that the methods used in this investigation, the findings, and their possible application to international aviation, should be further explored. The intention had been to determine the effects of such competition on service, rates and the payments needed from the Government to permit each company to cover its expenses.

Competition Keeps Down Fares

From the results it was concluded that airline competition had been, and was continuing to be, a major influence in keeping down fares on domestic routes and, by causing airlines to purchase new equipment, played a part in assuring the travelles of a high standard of schedule service. It was believed, however, that competition could be overdone. As an example the addition of a third carrier to the New York-San Francisco route was quoted. Since all carriers had scheduled flights at peak hours and were subsequently forced to make additional traffic stops in order to maintain adequate load-factors, a deterioration in service had resulted.

The most important consideration in regulating the degree of inter-line competition within the United States was held to be the control of the number of carriers rather than control of the frequency and capacity of their flights.

As to whether such conclusions applied equally to the international picture, Dr. Baker said that unfortunately the information which could provide good answers to such questions was not available. Until airline load-factors between major traffic centres were known "no sound conclusion could be reached as to the desirability of the control of frequency and capacity, in spite of all the generalizations which had been bandied about during the past five years." This was so because the heart of the problem was, it seemed to him, a quantitative one.

From experience gained by various industries, Dr. Baker selected four causes of excess capacity which might be applicable to the air transport industry. The first was that due to the efficiency of large-scale production, where, in many cases, a large plant was able to produce at lower unit cost than a small one. Continual fluctuations in actual or expected demand for the final product also caused over-capacity.

The third consideration was that of technological change. Here improvements within the industry might make new facilities necessary before the productive lines of existing ones were exhausted; as a result, the total capacity of the industry in both new and old facilities might be far in excess of requirements. A good example was seen in the shipping industry at the time of its transition from sail to steam. Finally, he said, the location of companies with an eye to national self-sufficiency—and in many instances with only secondary regard to economic factors—had led to over-capacity.

In their application to air transport the speaker dealt with each cause separately. As regards economies due to the large size of companies, he thought that, so far, there were no clear-cut indications that significant economies were possible in big companies which could not be matched by the very much smaller firms. Fluctuations in actual or expected demand seemed to explain part of the excess capacity on American domestic airlines shortly after World War II.

It was, however, too much to hope that all later estimates of future traffic would be reasonably accurate. For this reason we should probably count these fluctuations a future cause of excess capacity. Particularly applicable to air transport was the matter of technological change. The shift from twin-engined to four-engined transports had been made long before the former were "worn out," and the future certainly held the prospect of a change-over to turbojet and turboprop aircraft while piston-engined machines were still entirely serviceable. By far the most important reason for excess capacity was however, "the formation of companies according to national units."

Effects of Rate-cutting

In seeking remedies air transport might, again, benefit from the experience of other industries. The first of the general remedies and one which had been widely adopted in other industries was the "price war," which would mean competitive rate-cutting. Although the excess capacity would be utilized if rates were lowered sufficiently there was at the same time a very real danger that the resulting losses would far outweigh the losses at the "pre-price-war" rates. Dr. Baker thought that, if this proved to be the case, the cure would be worse than the disease. The ultimate effect of any general rate-cutting might be the cancellation of many of the international traffic agreements and the disharmony alone would be most unfortunate at this stage of international transport development.

The second remedy, that of buying-out or otherwise obtaining control of competitors, had often been suggested in civil aviation. In this case the effects of combining the overseas carriers of individual countries might well prove of limited value. Dr. Baker considered that this method was but "a blunt instrument, tending to reduce competition as such, rather than to eliminate only excess or wasteful competition." The price of such elimination in terms of service to the public could also be very great.

Put into operation on an international scale, however, there was no doubt that such a combination would eliminate some excess competition, provided that it did not do so by the simple expedient of eliminating all of it. It was suggested that the experience of the Scandinavian Airlines System would be of great value to those interested in planning such "international" companies.

Service-limiting Agreements

The third remedy was that of co-operative action. This might take the form of agreements which, as well as fixing rates, would also limit service. Under such an arrangement flights would be limited to the number required to handle available traffic at high load factors, thus permitting the disposal of surplus equipment and, consequently, lower operating costs. Numerous agreements of this type existed to-day and were the prevailing practice in Europe before World War II. The disadvantages of such a policy seemed to lie in the possibility of shutting out a major area in which competitive enterprise could struggle to advance the "art."

Dr. Baker hoped that in future any service-limiting agreements would be between companies and not nations, so that operators would be able to withdraw easily if necessary.

He thought that one of the major difficulties in all thinking

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Sizes ½" to 4". Manual or Electrical operation.

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The illustration is of the latest model with splined spindle, flush ends and hollow bolt construction. This latter feature permits attachment to airframe without disturbing the cock endplates or bolts. Also available with screwed ends. Sizes ½"—1½".

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A metallised version of the Saunders S.P. Cock produced for handling air or fluid up to 350°C. The 1" model (as illustrated) is now undergoing flight trials on the de Havilland Comet.

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The first of a series of large bore cocks for various duties. The 2½" model, for water injection followed by brief periods of air at 250°C. is now undergoing flight trials in the de Havilland Comet.

LITERATURE AND TECHNICAL INSTALLATION SHEETS NOW RECEIVED FROM THE PRINTERS WILL BE POSTED TO ALL INTERESTED ENQUIRERS.

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AIRLINE COMPETITION . . .

about the control of frequency and capacity, as well as competition in general, arose from taking a limited view of the whole problem. The proper view should include not only the aviation business aspects, but the broad political problem as well.

The low average load-factors seen on over-serviced routes was often due to the existence of several companies all struggling to get enough business to allow economical operation. These might be classed academically as the most efficient, the marginal and the sub-marginal. It was significant that while the marginal companies had reason to stay in the picture, the sub-marginal operators, who had little or no chance of economic operation, did not go out of business. They continued to operate at a loss, often by reason of national prestige or defence considerations, or merely because of broad economic relationships of their own country with other nations. The governments behind them appeared to believe that their losses were offset by a national gain somewhere else. Dr. Baker felt that thinking in this connection was often "fuzzy" and that a more hard-headed approach to the problem might well indicate that the various national interests were not necessarily furthered to a degree which would offset the real losses being suffered.

It was in such a period of continuing losses that the industry found itself living to-day. Under these conditions the very greatest care should be taken not to advocate the reduction of competition purely in order to minimize the losses which governments apparently felt were offset already by political or economic gains elsewhere. It was through competition that the industry would eventually be able to reach a condition where losses would not have to be made up from other sources.

On the question of how much it was safe to reduce present competition without affecting the chances of continuing important advances in the air transport world, the lecturer considered that, as it was difficult to choose the companies to be eliminated, it was more desirable to maintain the *status quo*. If it were possible to group existing lines into a few highly competitive operators, however, it would appear that little would be lost and much would be gained.

Summarizing the first part of his lecture, Dr. Baker stressed that there could be no prediction of what would happen in a situation where decisions had to be based on inadequate information. It seemed likely that competition from airlines and from surface carriers would tend to maintain the pressure for more control of service. It was vital that companies and governments should conform with the requests now being made by I.C.A.O. for the necessary information. If this were done it could be predicted that an industry with the foresight, capability and leadership which he believed existed in air transport could work out "some pretty wise formulation of the competitive problem."

The Troubled Future

Emphasizing that the foregoing remarks might be taken to apply to a possible World War III period, or to one which followed a much more troubled course of international affairs than that now prevailing, the speaker proceeded to approach the question of competition as he thought it would have to be handled in "the very troubled years which probably do lie ahead of us."

For the next five or ten years he thought that there were two major possibilities. The first was a period of world-wide war; the second, a continuation and probably an intensification of the present minor wars. In either case the national defence element previously mentioned would become more and more important and its impingement on the freedom of managements to determine to what extent they would compete with each other would become severe.

Turning to world-war possibilities, he was of the opinion that forces tending to restrict competition would result from the fact that, on outbreak of war, equipment and services become an integral part of military operations. Routes which in peacetime were not in use would become necessary in indirect support of the final all-important objective. In many countries, equipment would have to be taken from civilian non-essential employment and put to direct military use—a course which, if handled simply on the basis of military need, without regard to the effect on competitive relationships, might often result in the most serious competitive inequities.

It seemed inevitable, said the lecturer, that such inequities would make it essential to do away with competition in service as well as in rates during a world-war period. This could be achieved either by the merging of operations on any one route or by the continued operation by individual State and privately controlled companies under contracts to their own governments. In either case the governments would agree among themselves on the exact amount of service to be rendered. Moreover, it seemed unlikely that this elimination of competition would be limited to the belligerent nations, as with the total supply of transport equipment so limited in relation to the needs of a war effort, it was inevitable that the warring nations would wish to arrange for as many civilian routes as possible to be served by the aircraft of neutrals.

Also, in any foreseeable world conflict the nations involved would probably have an even stricter control of aviation petrol than was the case with maritime fuel during the last war, when fuel and insurance for neutral shipping was controlled by a U.K.-U.S. Combined Shipping Adjustment Board.

At the end of a future war the neutral airlines would be the operators with the latest experience, and probably with the public goodwill, on the routes on which the warring parties had withdrawn their operations. The main reason for the complete disappearance of serious competition would be not only that it would take more aircraft to preserve that competition, but that the job of preserving it fairly was almost insuperable. Even without competition on individual routes it would be difficult to apportion equipment and crews in the war effort without causing apparent inequities in the post-war opportunities of individual carriers.

Dr. Baker therefore considered it very important that the leaders of the transport industry should now look ahead to the establishment of some organization to plan the allocation of routes and equipment. The work of such a war-time board, he said, might well benefit from the experience of maritime shipping in the last war.

"Freezing" Competition

The lecturer then turned his attention to the second possibility—that in the next ten years or so there would be a series of "Korean Incidents." In such a situation the question of "fair" treatment in the placing of government pressure upon competing companies under the same flag to give up equipment, or possibly to have equipment actually requisitioned, would become even more difficult. Dr. Baker was of the opinion that if this was the kind of world we were going to live in we should probably end up with some type of international organization to make these decisions. The most likely way of meeting this situation, if it proved chronic, seemed to be the protection of existing competition by freezing it, or by exchanging losses on one route for benefits on another. All this would mean the lessening of service competition.

The lecturer said that he was rather doubtful of our chances of not experiencing, in the next ten years, one or other of the two situations which he had mentioned. It seemed, therefore, that the chances were not too good of companies being able to continue to enjoy the amount of "management freedom" which they now possessed. This was most unfortunate from the point of view of the advance of international air transport. In a peaceful world, and in view of the lack of vital information necessary to a wise conclusion, he thought it more constructive to leave the choice with managements, but, in the situation of continuing alerts or total war, it seemed essential that there should be international co-operation in the allocation of equipment, manpower and facilities. "At the moment," he said, "I do not see how this can be satisfactorily reconciled with the continuation of the present freedom of managemental decision on the service to be rendered to the public."

Atlantic-pact Possibilities

Dr. Baker expressed the view that international air transport interests would find it advantageous to co-operate in setting up under the North Atlantic Treaty Organization the same kind of arrangement which is already under way in shipping. Investigation would reveal that countries which were parties to the North Atlantic Pact controlled possibly 80 per cent of the aircraft not operated by the U.S.S.R. and its satellites.

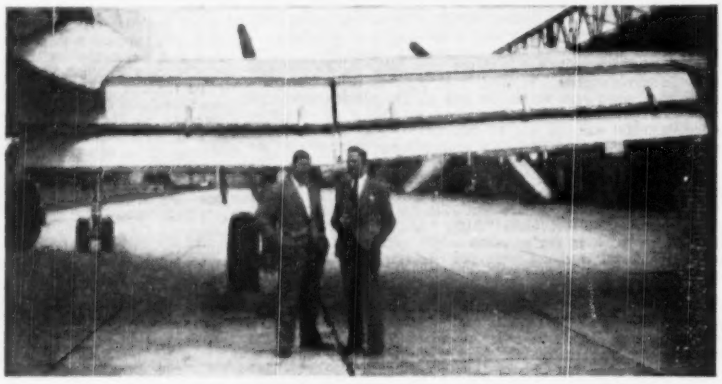
If we were fortunate enough to enjoy the luxury of world peace, the industry might best make progress by retaining full competition in service. There shou'd be agreements on capacity and frequency between companies and not nations; the problem could not be wisely resolved unless certain load-factor data, not yet in existence, were made available. In the event of a world war, competition as such could be written off.

If the world were faced with the third possibility—a series of relatively local outbursts of war—the tendency to greater control and less freedom would extend to the point where there was "little free, driving, productive enterprise left in the service part of the airline picture."

Dr. Baker was confident, however, that an international air-transport industry faced with a period of such difficult decisions, although it lacked the valuable experience gained by the shipping industry in World War II, nevertheless had "the quality of men to face reality, to plan ahead and, in the face of common danger, to reach the statesmanlike decision."

HERMES V IMPROVEMENTS

Introduction of Double-slotted Flap to Increase Take-off and Landing Weight



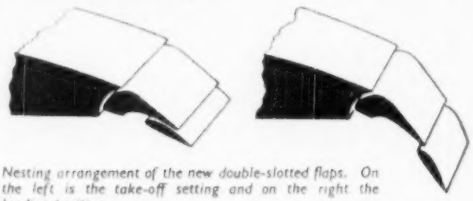
S. L. H. G. Hazelden, Handley Page chief test pilot, and Mr. R. S. Stafford, chief designer, are seen against the Hermes V wing. The new double flaps are in the fully-extended position.

HANDLEY PAGE have introduced on the Hermes V a double-slotted flap which, by increasing the maximum lift co-efficient makes possible a very useful increase in take-off and landing weights. Distance from take-off to 50ft is claimed to be reduced by 6 per cent for a given all-up weight, and there is a corresponding reduction of 3½ m.p.h. in stalling and safety speeds. Conversely, for a given take-off distance, the all-up weight can be increased by 2,000lb.

The landing run, for a given all-up weight is stated to be reduced by 10 per cent or, alternatively, for the landing distance associated with the previous single-slotted flap, the all-up weight is increased by as much as 6,000lb. Stalling and approach speeds *vis-à-vis* those with single-slotted flaps are reduced by 6 m.p.h. (presumably at the present maximum landing weight).

The new double-slotted flap consists of a main flap of 15 per cent wing chord, in the underside of which is nested a second, smaller flap of 9 per cent wing chord. When the main flap is lowered, the inset correspondingly moves rearward and downward relative to its parent flap. The effective increase in chord for take-off is 7 per cent by comparison with the 2½ per cent given by the single-slotted type. For landing, the increase is 12½ per cent against 4 per cent. Take-off angles for the double flap are 20 deg and 32½ deg respectively (both relative to the wing) as compared with 40 deg for the single flap. Comparable figures for the landing case are 40 deg and 64 deg as against 60 deg.

The Hermes IV, with its small standard flaps, has recently been flown on trials by B.O.A.C. at an all-up weight of 86,000lb—i.e., an increase of 4,000lb—and the manufacturers hope to have the Hermes IV cleared for operation at this all-up weight even from high-altitude airfields on the African routes. Whether or not B.O.A.C. will consider adopting the new double-slotted flap as a retrospective modification for the Hermes IV is a matter for conjecture, but it would be a modification (to trailing edges, hydraulic system and with new jacks) which could be undertaken without great difficulty; and it would appear to be one well worth while on an aircraft with almost its full operational life-span still ahead of it.



Nesting arrangement of the new double-slotted flaps. On the left is the take-off setting and on the right the landing position.

COMET DEVELOPMENT POSSIBILITIES

A Third Aircraft Completed : Version with Axial Turbojets Planned

THE date for commencement of delivery of Comets to B.O.A.C. is now rapidly drawing near. The first production aircraft, fully equipped for airline service, is due to be ready during July, and the machine in question was wheeled out (on its bogie undercarriage) for the first time last week. It is expected to fly before Christmas.

Early in the New Year—February is the month in mind—the second M.o.S. prototype, which has already done some 70 hours flying, it to be loaned to B.O.A.C. for experience and route trials. The first machine now has well over 400 hours.

By the time an aircraft has reached the advanced development stage achieved by the Comet, enough experience has been gained for development possibilities to be explored. Therefore, it was not surprising to learn, last week, that what has been termed a "Phase 2" Comet, with more powerful axial-flow turbojets, has been discussed. Such a project was, in fact, foreshadowed in *Flight* twelve months ago, and at about that time plans for an Avon-Comet were rumoured in some quarters. This was a little premature, but the development of large axial gas-turbines has been more rapid than might have been expected. This is, in part, the reason for the announcement of plans to build a re-engined Comet even before the original machines are in service.

Because of vital military priorities it is not by any means certain that Rolls-Royce Avons will be the high-power axial units selected, even though they are undoubtedly suitable for the purpose. Presumably, as a result of the big increase in the rate of English Electric Canberra production, which will follow the sub-contract arrangements just completed with the A. V. Roe, Short and Handley Page companies, Avons will be in even greater demand.

Ghost-engined production Comets, which will shortly be delivered, have a number of particular attractions for medium-range routes of the type on which they will first be introduced. Naturally, however, operators who have already indicated their interest in the new proposals—including B.O.A.C.—will wish to see the unique qualities of the Comet made available on the longer-range routes where jet-speed and comfort are even more to be appreciated. It is the long-range possibilities which have prompted the study of a re-engined version of the Comet, new axial-turbojet designs being capable of operation at lower specific fuel consumptions than are the military and civil units now in service. Such an aircraft would be able to tackle the North Atlantic route—on occasions direct—without recourse to flight refuelling, which presents certain practical difficulties for such aircraft at the present stage. High fuel consumption remains the limiting factor in the commercial operation of turbojet aircraft.

An impression of Comet development of a few years hence may be conjured up by piecing together the oddments of information which have been released, and by drawing a parallel with the development of successful airliners of the previous piston-engined generation. Characteristics might be as follows: Power from four axial-flow turbojets of about 8,000 lb thrust, each with specific fuel consumption in the region of 0.75 lb/hr/lb thrust; increased internal tankage (D.H. statement, December, 1949); slightly longer fuselage accommodating about 50 passengers and

a flight crew of two or three (notes of October, 1949); an all-up weight increase from the present 105,000 lb to 120,000 lb (foreseen by Mr. C. C. Walker, chief engineer, in December, 1949). Such a Comet should then be capable of carrying nearly double its present capacity payload of 12,000 lb, for, to use the makers' term, a "practical range" of over 3,000 miles. Speed and altitude of operation would probably be kept to much the same round figures as at present, namely, 500 m.p.h. at 40,000ft.

Returning from these imaginary developments to those immediately foreseen for the B.O.A.C. Ghost-powered Comets, it may be recalled that a year ago at about the same time that the eight-wheeled bogie landing-gear was first tried out, it was stated that increased internal fuel capacity was to be provided, and Major Halford said that 3 to 5 per cent improvement in fuel consumption ought to be achieved. In addition, he thought that a 10 per cent thrust increase for take-off—a total of 2,000 lb for the four Ghosts—would be achieved as a result of employing water injection.

NEW FAIREY PROTOTYPES

REVIEWING a year's progress by the Fairey Aviation Co., Ltd., at the company's annual general meeting last week, Sir Richard Fairey, M.B.E., Hon. F.R.Ae.S. (chairman and managing director), said that the Fairey 17 was now undergoing final trials and that the prototype had done extensive flying. Progress of the trials, which it was hoped would be completed this year, had been affected by "numerous alterations in design from the original specification" as a result of the "continually changing requirements of the Royal Navy, imposed by the need to meet new developments in anti-submarine warfare."

Another prototype, designed for experiment in "new and revolutionary possibilities," had been completed and would shortly undergo trials, and the company's engineering department was also engaged upon yet another even more advanced type of aircraft for which a contract had been obtained from the Ministry of Supply. In addition, a contract for a prototype of a rotating-wing aircraft larger than the Gyrodyne had been received. This was of novel form with considerable possibilities both in military and commercial fields.

Certain successful work had been done in the guided-weapon field, and had received the encouragement of the M.o.S. An important contract had now been obtained in this connection.

Referring to some of the company's other interests, Sir Richard stated that the Fairey Aviation Co. of Canada had emerged with a profit in its first year of operation, and appeared to be giving every satisfaction to the Canadian Government departments for whom it worked. Extensions were under discussion, and a senior engineer had been sent to Canada to organize a technical department for future design work.

The Belgian subsidiary, Avions Fairey, had also made a good profit and continued to increase its activities.

The Air Survey group of companies had not yet reached the profit-making stage, but prospects appeared to be improving, and contracts for photographic and mapping work were on the increase.

Sir Richard regretted that there was little to report on the subject of the Great West Aerodrome now incorporated in London Airport. Of White Waltham airfield he said that in view of the conditions resulting from the Town and Country Planning Act, and "the unsatisfactory, indeed unworkable stipulations that were insisted upon in any sale of White Waltham Aerodrome,' the directors had decided that it would not be in the company's interests to purchase the freehold.

On the question of new prototypes and Government finance the chairman said that owing to the increased size and greatly enhanced complexity of structure and equipment of the modern aircraft, the time necessary to design and produce a new prototype and bring it to the production stage was greatly increased. It followed that considerably more capital was invested in a new prototype than had been the case in the past. However, the profits derived from production contracts did not permit the company to carry so large a share of the burden, and they must look to the Government to an increasing extent to finance the design and development of apparatus to their own requirements.

The financial statement showed that the group's available profits, less losses, amounted to £282,805 after provisions. After deduction of profits, less losses, retained by subsidiary companies, there remained a net profit of £243,264 as against £212,424 last year.

It was recommended that £100,000 be transferred to the reserve for research and development, that an amount of £50,000 be provided against investments in subsidiary companies and to cover the loss which would be incurred consequent on the decision to dispose of the company's interest in Weatherley Oilgear, Ltd., and that the contribution to the staff pension fund be raised to £25,000.

Regarding the dividend payable, the directors recommended that there be a small increase to 2s 6d per share, less income tax, as compared with the rate of 2s per share per annum of the past 3½ years.

CAPT. SPRY LEVERTON

WITH great regret *Flight* records the death—within five weeks of his retirement as regional director of K.L.M. (Royal Dutch Airlines)—of Capt. Henry Spry Leverton, O.B.E. He died on November 26th at his Woodmansterne, Surrey, home.

Capt. Spry Leverton

"Spry," as he was known throughout the air-transport business, was born in 1890 and was educated at Rossal School. He soldiered in France during the First World War, and, before joining K.L.M. in 1921 as airport manager at Croydon, he worked with the Air Transport and Travel Company—Britain's first airline operators. From his lively brain came some of the most sparkling commentary to appear in the British aeronautical Press, and before the recent war, under the title "The Week at Croydon" and the pseudonym "A. Viator," he made a regular and very popular contribution to the commercial aviation columns of this journal.

During the war years he was in charge of the ground organization responsible for arranging special V.I.P. flights from Great Britain, and for his services in this connection he was awarded the O.B.E. He was also an Officer of the Order of Oranje Nassau.

OCTOBER AIRCRAFT EXPORTS

EXPORTS by the British aircraft industry for October, at £2,531,307, show an increase of £176,601 in comparison with the September total. The figure comprises 55 complete aircraft (£852,023), 132 engines (£438,102), accessories to the value of £1,225,650 and tyres worth £15,532.

For the first ten months of the year, exports have been equivalent to an annual rate of £35¼ million as against £34¼ million in 1949. The total for the third quarter of the year is £8,731,273.

The October export gain is in some respects offset by the fact that imports also increased—by £286,093 in comparison with September. The October import total is £965,801, £50,200 of which represents the price of five complete aircraft and the remainder accessories.

C.A.S. SEES C.F.100: Marshal of the R.A.F. Sir John Slessor, in unfamiliar headgear, during his visit to the A.V. Roe Canada works at Malton, Ontario. He is seen inspecting the pilots' cockpit of the C.F.100 Canuck all-weather fighter, accompanied by Mr. E. H. Atkin, Avro Canada chief engineer.

NATIONAL AIR RACES, 1951

Details of the Events to be Flown at the One-day Hatfield Meeting

ALL the major air races for 1951 are to be flown on one Saturday in June, when a special meeting will be held for what are to be called the Festival of Britain 1951 National Air Races.

Although there was much to be said for the air-race arrangements last summer and in previous years, there were a number of serious disadvantages, chiefly concerned with organization and expense. While regretting that the races cannot be "farmed out" again to enable people in all parts of the country to see one or more of the events near their homes, we welcome both the plans and the choice of Hatfield for the combined events.

Situated in Hertfordshire, some twenty miles by road to the north of London, Hatfield is well placed for the occasion, both for visitors from home and for the many people whom the country hopes to welcome to London for the Festival. Moreover, the home of de Havillands has been intimately connected with all kinds of aircraft as well as with air displays, exhibitions and competitive events for very many years.

Under the new arrangements the Royal Aero Club will, as usual, organize the races, and they will be sponsored by the Kemsley Flying Trust. Prize money will amount to more than £2,000, and all the well-known trophies will be competed for in two combined events both taking place on the same day—Saturday, June 23rd. A third separate race—that for the R.Aux.A.F. Squadrons' Cooper Trophy—may be included in the programme as there will not be an R.A.F. display next year.

Full details of the meeting, and entry forms for the races, will be made available by the Royal Aero Club (119, Piccadilly, London, W.1) in the new year. In the meantime, a proposed programme has been evolved as follows:—

(1) Start of The King's Cup Air Race (national); Kemsley Challenge Trophy Race (international); Norton-Griffiths Challenge Race (international); Grosvenor Challenge Cup Race (international). (2) Individual glider aerobatics. (3) Competitors in these events pass the Hatfield turning-point. (4) Finish of the races and landing of competing aircraft. (5) Individual aerobatics. (6) Special item (possibly the R.Aux.A.F. Inter-Squadron Race). (7) Team aerobatics. (8) The R.Ae.C. Jubilee Trophy Race (international); S.B.A.C. Challenge Cup Race (international); Air League Challenge Cup Race (international). (9) Parachute-jumping competition (national). (10) Presentation of prizes.

Details of the races are as follows:—

The King's Cup Air Race.—A handicap race open to British subjects flying British-built aircraft having a fully-loaded weight at take-off not exceeding 5,000 lb and a maximum speed at sea-level of not less than 110 m.p.h. The race will be over a cross-country course starting and finishing at Hatfield Aerodrome and terminating in a closed circuit of 33 miles. Total distance, about 167 miles.

The Kemsley Challenge Trophy Air Race; The Norton-Griffiths Challenge Trophy Race; The Grosvenor Challenge Cup Race.—International non-handicap speed races for aircraft classified according to fully-loaded weight. To be flown over the same course, and concurrently with, the King's Cup Race.

The Royal Aero Club Jubilee Trophy Race.—An international handicap over three laps of a quadrilateral closed circuit course (of about 33 miles) based upon Hatfield Aerodrome, for aircraft with a maximum speed at sea-level exceeding 250 m.p.h.

S.B.A.C. Challenge Cup Race; Air League Challenge Cup Race.—These are international non-handicap races—the S.B.A.C. Cup for jet-powered aircraft and the Air League Cup for piston-engined aircraft—over the same closed-circuit course, and concurrently with, the Jubilee Trophy Race.

The Geoffrey de Havilland Trophy will be awarded to the British pilot who obtains the fastest lap speed during the meeting.

The Siddeley Challenge Trophy will be awarded to the British flying club whose nominated representative obtains the highest place in the King's Cup Race.

AN AIRSPEED APPOINTMENT

BUSINESS manager of Airspeed, Ltd., for the past thirteen years, Mr. W. F. Shaylor has been appointed to the board of the company. Apart from his more direct duties he has always been a strong influence in the firm and his appointment will come as no surprise to those who know him. Mr. Shaylor learned to fly in 1917 at Stag Lane and served in the R.F.C. with a Camel-equipped fighter squadron. After a period of demobilization, he rejoined the Service in 1921, flying with No. 1 Squadron in Kurdistan and later with a Snipe squadron on home service. After finally leaving the R.A.F. in 1926, he was appointed to a civilian technical post at Halton Camp.

Mr. W. F. Shaylor.

In 1927 he went to Canada, took a commission in the R.C.A.F. and became an instructor. Later he flew with Canadian air-operating companies and was respectively general manager of Skyways (Toronto and Montreal) and managing director of Northern Skyways (Quebec) between the years of 1929 and 1934. Returning to England in 1934, he was appointed sales manager to Pobjoy Airmotors and Aircraft. He joined Airspeed in 1937 as business manager.

"CIVIL MILITARY" Cs. OF A.

FOR some time past the Air Registration Board has been considering the question of Certificates of Airworthiness for ex-military aircraft, and new conditions which will have the effect of restricting the civil use of purely military aircraft are now announced with the concurrence of the M.C.A.

Introducing the requirements, the A.R.B. mentions "certain design-features which, while acceptable from a military aspect, are unsatisfactory when related to civil aircraft," and "concessions granted during the war in regard to alternative materials and manufacturing processes."

The new conditions are as follows:—

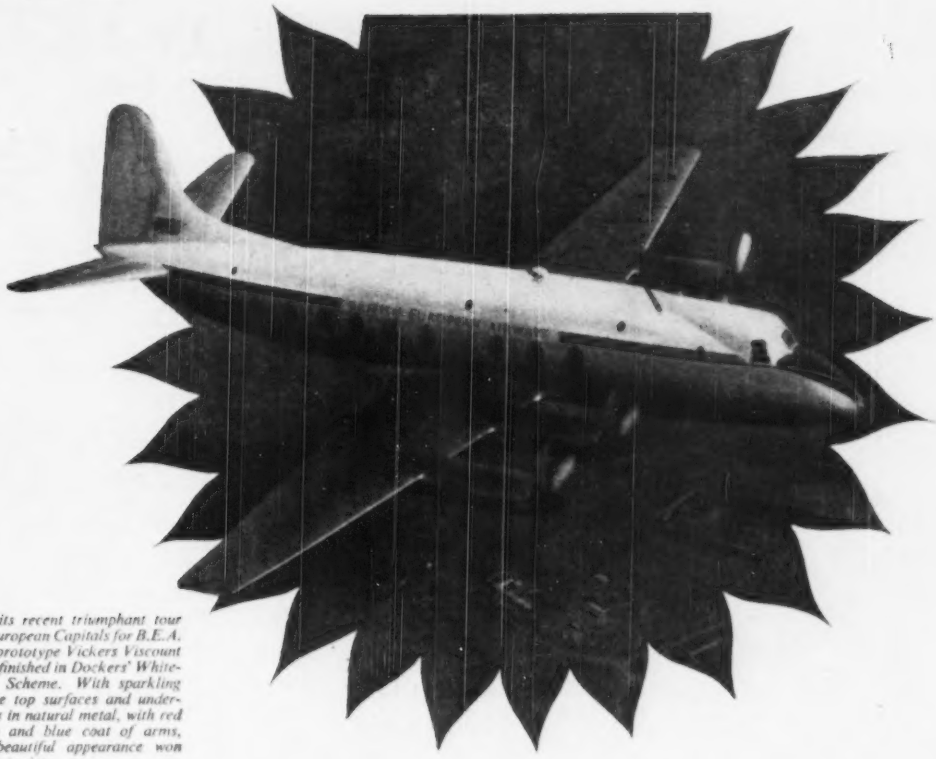
(a) Military aircraft constructed during or after the war to pre-war civil designs, and which are of types which were in quantity production as civil aircraft before the war, will continue to be certified subject to inspection and incorporation of any modifications stipulated.

(b) Military aircraft of all types constructed to pre-war and war-period military designs will not be certified except in very exceptional circumstances. Normally an application for a Certificate of Airworthiness for such an aircraft will not be entertained after December 31st, 1950.

(c) Military aircraft constructed to post-war military designs will only be certified if they comply with current British Civil Airworthiness Requirements.

(d) Ex-military aircraft which have already been certified and continue to meet the Board's requirements will be eligible for renewal of their Cs. of A. until further notice.

HAWKER-SIDDELEY SENIOR APPOINTMENTS: Mr. H. M. Woodhams, C.B.E., F.R.Ae.S. (lower left) is now managing director of Sir W. G. Armstrong Whitworth Aircraft; above, left, is Mr. H. T. Chapman, A.F.R.Ae.S., who is Armstrong Siddeley's new managing director; (top right) Mr. W. F. Saxton, M.B.E., their new technical and works director; (bottom right) Mr. W. H. Lindsey, M.A., F.R.Ae.S., chief engineer



On its recent triumphant tour of European Capitals for B.E.A. the prototype Vickers Viscount was finished in Dockers' White-Top Scheme. With sparkling white top surfaces and undersides in natural metal, with red trim and blue coat of arms, its beautiful appearance won high praise.

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The great reflective strength of this white finish, which has been specially developed by Docker Brothers, keeps the interior of the cabin *at least 15°F. cooler* than normal, when the aircraft is standing in the sun on the ground. A striking contribution to passenger comfort, particularly in very hot climates! Dockers' White-Top Scheme gives complete surface protection and embodies materials fully approved by A.R.B. and A.I.D. If used after Dockers' "Double-One" Etching Primer, it does not call for any pre-treatment of the skin. Further details will be gladly supplied on request.

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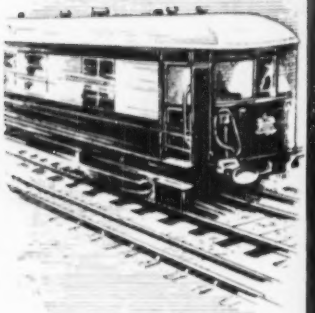

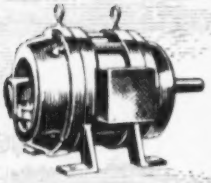

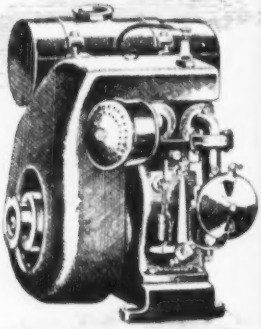

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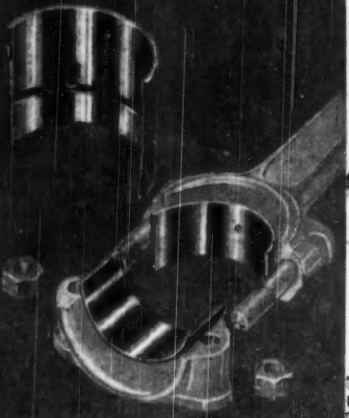

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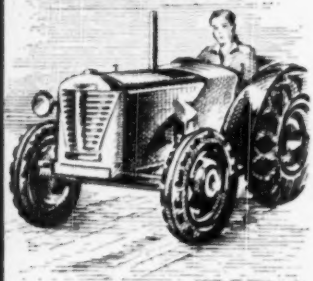
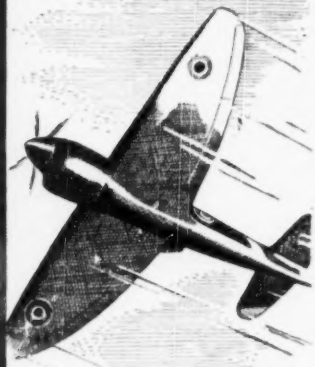
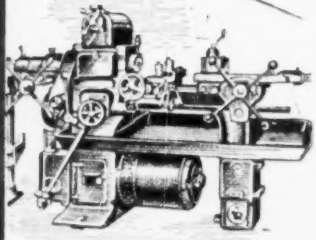






CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

H.P.42 History

REGARDING recent information published in *Flight* about the H.P.42, I am able to supplement one of the facts mentioned. *Horsa* G-AAUC and *Hadrian* G-AAUE were both seen in their war paint at Doncaster Airport during 1942. One of these machines, picketed in the open, was blown adrift and completely wrecked by a gale in that year. In view of Captain Brown's letter in *Flight* of October 5th, I conclude the wrecked machine would have been *Hadrian*.

Doncaster. L. A. CLARK.

Airline Comfort

WITH reference to Mr. I. Scott-Buccleuch's letter on "Airline Comfort" in your issue of November 16th, the aim of all scheduled airline operators is to fit their aircraft to the routes in the most profitable manner compatible with the operational performance of the type on the one hand and the length and physical nature of the journeys from the passenger's angle on the other.

B.O.A.C. is no exception in this and, as your correspondent would seem to suggest, the examples of our passenger seating quoted by him are primarily due to the range and payload characteristics of the particular types.

The increase in seating capacity of the Solents was a typical case where, after initial operating experience, a higher take-off weight along the routes became possible, and performance generally was progressively improved. This commonly occurs during the initial operation of a new type as the result of upward revisions of engine power, and so on. For example, the Hermes IV has now had its all-up weight increased from 82,000 to 86,000lb, and this is in process of implementation.

Sometimes, as the result of having to operate a particular type of aircraft on route sectors above the optimum distance for best payload, greater passenger comfort (or "luxury") can be offered, because payload then becomes weight-limited, and greater space per passenger is automatically available. Examples of this are frequently seen where operators are using sleeperette-type seats which otherwise could not be provided. The carriage of considerable quantities of mail or freight on passenger services, as is common on B.O.A.C.'s overseas routes, is another factor contributing to what otherwise might appear to be an extravagant spacing of passenger seats.

It was naturally our aim to establish an interior layout which gives the most profitable volumetric payload in relation to the average sector fuel weights estimated to give an acceptable degree of operational regularity.

London, W.1. F. C. GILLMAN,
British Overseas Airways Corporation.

Sidewash and Stability

WITH reference to Mr. Wreford-Bush's letter in *Flight* of August 24th, criticizing my article of the above title published in *Flight* of July 27th, I should like to apologize for the delay in making this reply, but I received the appropriate copy of *Flight* only a few days ago.

Whilst agreeing with my critic that the figures quoted in my article for the Hawker P.1040 and P.1052 are, perhaps, incorrect (they were obtained from miniature three-view G.A. drawings) I do not think that the real figures are as high as Mr. Wreford-Bush quotes. I should not be at all surprised if the aircraft in question did not show some oscillatory tendencies. Perhaps Mr. Wreford-Bush did not quite see what I meant by the fin area *above the fuselage* (SFR) in my approximate formula relating the fin size required to the fuselage size.

This formula forms a departure from the well-established method of estimating n_v according to R.A.E. and R.Ae.S. data sheets, where the fin area is represented as "the gross area" *including* a part formed by the fin and fuselage *beneath the tailplane*. However, the fin p/q tests that I have seen in flight and in wind tunnels have convinced me that the theoretical indicated inefficiency of that part of the fin under the tailplane is a fact. The reason for it can easily be explained when one considers the fuselage top sidewash annihilated locally by the tailplane frontal downwash due to its own lifting line, this being especially apparent when the tailplane is mounted above a circular fuselage. One should try to separate the fin from the tailplane, and if the tailplane must be mounted away from the high-speed wake of the wing, then it should be put either right on top of the fin or right below it, even if it means using anhedral. For further studies of the subject, I would recommend *Aerodynamics of the Fuselage*, by H. Multhopp. This is available as an M.O.S. translation (R.T.P. No. 1220).

I agree with Mr. Wreford-Bush that my formula is approximate, but then, so is the R.Ae.S. method. By the latter, one can make practically every modern aircraft look stable or unstable on paper—depending, for example, on how much one allows for, say, canopy height. Furthermore, the R.Ae.S. method of estimating n, does not lend itself easily to project work, where one has to relate stability with performance and weight in a hundred and one variants. The old rule of tail volume also fails when one starts changing the wing loading and aspect ratio. Such is the "exact" science of aerodynamics. Nevertheless, one has to find some method of quick comparison for project work, and my formula gave me the best approximation so far available. I think it worth mentioning that most aircraft which show low values in the tables published in my original article have had stability troubles. I should be pleased to hear if Mr. Wreford-Bush has anything better to offer as a rough recipe for project work.

Further to other points raised by my critic, I agree that the paragraph concerning stability effects of the fuselage nose shape does not specifically state that the fuselage discussed is in the presence of the wing: that much I took to be assumed. I must, however, disagree with Mr. Wreford-Bush when he claims that my formula does not take the fuselage nose shape into account. It is, in fact, the very thing that the formula does take into account, containing, in effect, the term of fuselage volume and mean width in front of the c.g. H. K. MILLICER.

Melbourne, Australia.

An Expert on Veterans

I HAVE been most interested in the correspondence concerning veteran aircraft which has appeared in recent issues of *Flight*, and I believe I might be able to assist in clearing up some of the points raised.

Firstly. One of your very rare caption mistakes occurred in your R.A.F. Display report, when the photo of the Shuttleworth 1909 Bleriot XI was depicted as the Gordon Bennett Bleriot. This slip undoubtedly occurred owing to the fact that my 1911 Gordon Bennett Cup Bleriot XXVII was displayed in the static park.

I believe the points raised in other letters had better be generally covered by referring to the Bleriot types, as correspondents appear to have mixed up the Bleriot XI and XII in connection with Gordon Bennett events. Mr. Curtis also mentions that the Shuttleworth Bleriot had a "Cross-Channel type" rudder before the war. This latter point can be cleared up by my mentioning that my No. 5 Bleriot XI, which comprised No. 5 fuselage and engine and the remainder rebuilt from original Bleriot works drawings, was fitted with the Cross-Channel type rudder for film purposes and was also fitted with the Cross-Channel wings, which gave a span about 18in less than the production type XI. The Shuttleworth Bleriot attained at least 200ft altitude and my No. 5 short-span flyer about 100ft, before the war (1939-45); my No. 5 was probably very slightly faster. These altitudes were often accomplished in the period 1909-10 and, in fact, M. Molon on my Type XI No. 54 accomplished 600ft towards the end of 1909.

The actual Cross-Channel Bleriot XI had a rudder with a single balanced portion above the fuselage and this general appearance (not necessarily exact design) also applied to the 1911 type XIbis and the 1912 type XXI. The Bleriot types IV, IX, XI and XIa all had rudders of practically identical appearance, there being a balanced portion above and below the fuselage, similar to two horns.

There is mention of a Bleriot which was flown at Rheims other than the types XI and which housed the pilot inside the fuselage. This was the Type XII Bleriot high-wing monoplane and was brought out in 1910. It had type XI wings and various motors were fitted, including an eight-cylinder E.N.V., Green, and Darracq of about 35 h.p., water-cooled. I believe a Gnome was also fitted. Bleriot first flew this type at Pau and it was also flown by Grahame-White. Speeds of 45 to 60 m.p.h. were attained.

The Gordon Bennett Bleriots were of types XI and XIa design, fitted with Gnome 50 and 100 h.p. motors for 1910-11 and Type XXVII fitted with 50, 70 and 100 h.p. Gnomes for

CORRESPONDENCE . . .

1911-12. The 100 h.p. was a twin-row motor and was used for racing purposes. A twin-row 140 h.p. Gnome was produced before the 1914 war.

The actual type XXVII which I possess was first flown by M. Alfred Leblanc (Bleriot's test pilot) at Hardelot, where it attained 78 m.p.h. This machine was also flown in the U.S.A., mainly by John Moisant, and later spent the 1914-18 war in Havre docks.

In addition to the above-mentioned machines Bleriot constructed several with modifications such as clipped wings, but they did not prove successful.

The Bleriot XXI was designated for military purposes and was practically identical to the Type XXVII, except that it was arranged for side-by-side seating. A 70 h.p. Gnome motor was usually fitted.

As to the Blackburn aircraft correspondence, I have only been able to find out that five aircraft were built in 1912 and that two of these were for military purposes, which means that there may have been three of practically the same design being flown in this country in 1912-13.

R. G. J. NASH.

Weybridge, Surrey.

Flying Maps

HAVING recently been flying from an airfield near London which is roughly on the corner of each of the four southern sheets of the 1:500,000 Air Map, I tried to get hold of a copy of the "Special Edition" (Southern England and Wales, "half million") which combines all four and, covering the whole country south of Sheffield, is an ideal single-sheet map. It proved out of print and I was fobbed off with the provisional I.C.A.O. edition giving the same coverage. My disgust with this latter compels me to register the following complaints:—

It omits airfield heights A.S.L. and should surely have names as well as identity letters. The differentiation between single and multiple-track railways requires more than a glance, particularly at branches. (The system as it is could, anyway, be extended to give the actual number of tracks.) Heights in metres are little use to the busy pilot whose altimeter is calibrated in feet. An overprint of a lake (blue) on a town (yellow) only results in a wood (green).

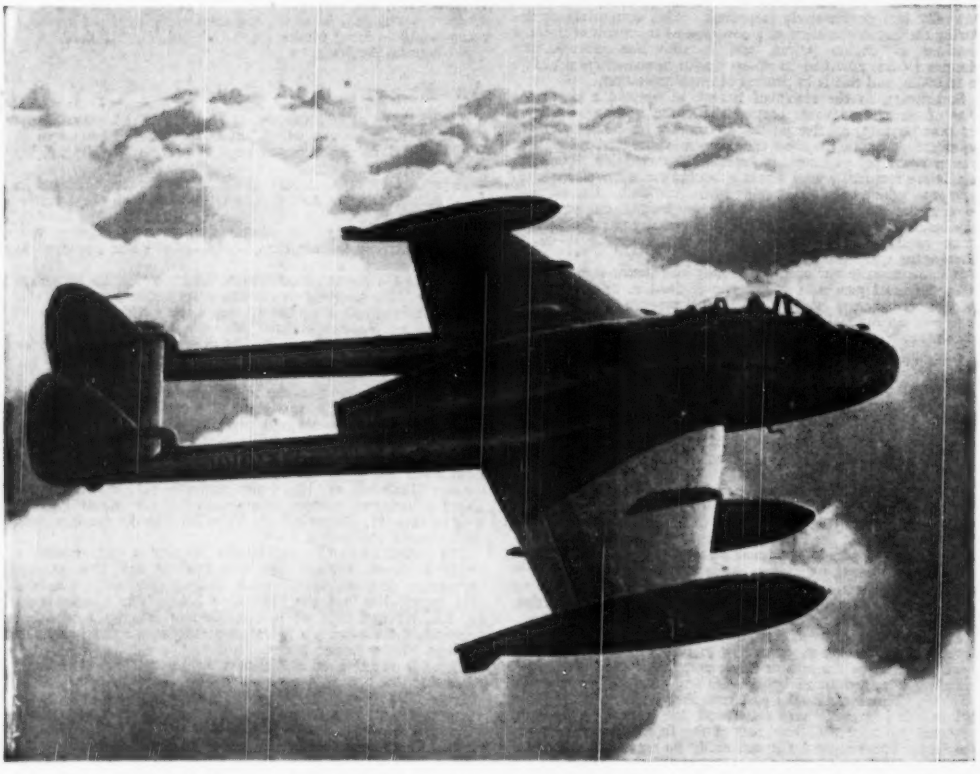
It is fundamentally inaccurate. For example, North Weald Airfield, Lee-on-Solent, Gosport, etc., are not marked; Shoreham Airfield is shown on the wrong side of the river; the Epping W/T masts are not among indicated obstructions; and since when has Cambridge Airfield been known as Teversham, or Cowes as Somerton?

If our representatives at international conferences abroad, besides losing us the Airmet broadcast frequency, can agree to sponsor maps such as this, I would like to make one plea. Could we have a final reprint of the old Southern England and Wales single-sheet first, and a chance to stock up with it, before this pitifully poor international plan is finally forced on us?

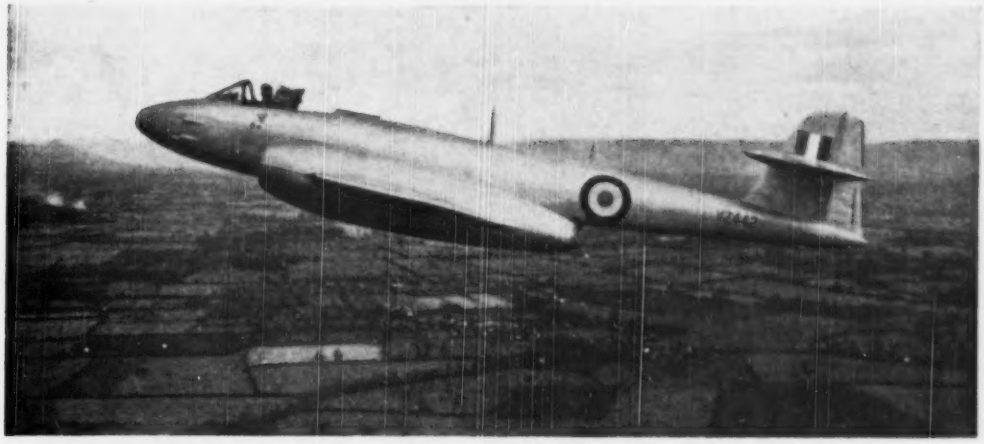
Cambridge. PETER VANNECK.

[We understand that the I.C.A.O. provisional edition is admitted to have certain shortcomings, and that an improved version will be available in about six months. At the same time, civil pilots do not normally need to know the names of Service airfields which, since they number some hundreds, would further confuse a map of this scale.—ED.]

RESISTANT TO ALL KNOWN ANTIDOTES : THE D.H. VENOM F.B.1



Informative new study of the de Havilland Venom F.B.1 fighter-bomber, now in quantity production for the R.A.F. Note the finned wing-tip tanks, fully stressed for combat manœuvres, the under-wing tanks and the boundary-layer "fences." The Venom is powered with a D. H. Ghost and excels in the high-altitude interceptor, long-range fighter and low-level attack roles. A two-seater night fighter development has been adopted by the Royal Navy in succession to the Sea Hornet N.F.21. Valuable deck-flying experience has been gained with a small batch of Sea Vampires.



FRESH-AIR TEST: This Gloster Meteor 8 was recently flown without a cockpit canopy to test the aerodynamic effects of the omission at various speeds and attitudes. Test-pilot J. Zurakowski occupied the Martin-Baker ejector seat, clearly visible in this photograph.

SERVICE AVIATION

Royal Air Force and Naval Aviation News and Announcements

"A Healthy Organization"

SPEAKING in London at the annual dinner of the Air Public Relations Association on November 24th, Marshal of the R.A.F. Sir John Slessor, Chief of the Air Staff, referred to the recent pay increases and improved conditions of service: "We have now got a really fair deal for the R.A.F. and the Services as a whole. It's our fault now if we cannot get the chaps."

He had never believed that attracting recruits depended purely on the question of pay, but one could not expect people to join from a love of adventure if there was not a reasonably decent standard of living.

Speaking of the R.A.F. to-day, Sir John described it as "fundamentally a healthy organization—far healthier than ever before in peace." There was only one thing wrong with the Service at present: it was not nearly big enough. Considerable expansion was under way, but the temptation to put all our resources "in the shop window" was being resisted.

Quicker Commissioning

A NEW system of commissioning pilots and navigators was announced last Friday by the Air Minister, Mr. Arthur Henderson, when he visited fighter stations at North Weald. In future, he said, men accepted for training in these categories would be made acting pilot officers when they had satisfactorily completed ground and officer training, i.e., after six months' service—about a year earlier than under the present system of awarding commissions at the "wings" stage. By the new arrangement the R.A.F. hoped to attract more candidates of the high quality required.

During the initial six-month period they would serve as aircrew cadets, receiving 49s 6d per week. On promotion to acting pilot officer, pay would rise to £5 5s for a probationary six months and £5 19s for the remainder of the training period. (A pilot officer normally receives, with flying pay, £8 11s 6d weekly.) Commissions would be for eight years' active and four years' reserve service, with a gratuity of £1,500. All short-service officers, said Mr. Henderson, had a good chance of selection for permanent commissions.

National Service Pilots

TEN National Service men were among 16 officer cadets receiving their pilots' wings at a passing-out parade held at the R.A.F. Flying Training School, Ternhill, Salop., on November 22nd. The parade was taken by Air Vice-Marshal F. F. Inglis, C.B., C.B.E., Senior Air Staff Officer, Flying Training Command.

Air Ministry Appointment

GROUP CAPTAIN T. U. C. SHIRLEY, C.B.E., formerly Deputy Director of Technical Plans at the Air Ministry, has succeeded A. Cdre. A. F. Hutton as Director of Servicing and Repair, Air Ministry, with the acting rank of Air Commodore.

A signals specialist, A. Cdre. Shirley served at R.A.F. Headquarters in the Far East and Middle East; at the Air Ministry, in the Directorate-General of Signals and the Directorate of Radio; and in command of signals wings in the United Kingdom during the war. He was afterwards Deputy Director of Signals at the Air Ministry and Chief Signals Officer at Headquarters, Transport Command. He joined the R.A.F. as an apprentice in 1926, began a Cranwell cadetship in 1928 and was commissioned two years later.

R.A.F. Korean Operations

THE two R.A.F. flying boat squadrons, Nos. 88 and 209, operating from Japan in the Korean war, continue to be engaged in conjunction with United Nations naval forces in round-the-clock patrols over Korea's blockaded sea approaches. They share moorings at Iwakuni with flying boats of the U.S. Navy Air Arm, and while the Royal Navy and the R.A.F. keep close watch over the western waters the U.S. Navy keeps a parallel watch in the Eastern channels. Not only do the aircraft track down fugitive enemy ships but they also help in spotting mines and on occasions have flown air-sea rescue missions in attempts to locate survivors of mined vessels.

Freighter Goes North

THE R.C.A.F. Winter Experimental Establishment recently sent a four-man crew to Filton to take charge of a Bristol Freighter, which has now been flown to Canada by F/L. F. J. Fewell for a programme of cold-weather testing due to last till next March. Two Bristol engineers will assist in the maintenance of the aircraft. During the next four months the Freighter will divide its time between the Establishment H.Q. at Edmonton, Alberta, and the northern advance posts at Fort Churchill, Manitoba, and Watson Lake, Yukon.

The R.C.A.F., which is testing the aircraft by agreement with the Ministry of Supply, will make good use of its capabilities as a transport, using it to carry personnel and supplies to the outposts. Tests will be undertaken in temperatures which have been known to fall as low as −65 deg C. The Freighter will be left out of doors at night and will be started from cold in the morning; some 60-70 per cent of its operating time will, in fact, be spent in ground-running and starting. Special canvas covers have been designed

SERVICE AVIATION . . .

for the aircraft to prevent the ingress of snow to the Hercules engines, nose, control surfaces and undercarriage. The latest methods of de-frosting, de-icing, and oil-dilution will be employed.

This is not the first occasion on which a Freighter has operated in the Arctic; an earlier version visited Edmonton, Yellowknife and Knob Lake, Labrador, during a 1946 demonstration tour of the Americas.

The "Aries" Record

FOLLOWING confirmation of a London-Khartoum flight on October 20th-21st, three official point-to-point records now stand to the credit of various R.A.F. aircraft named *Aries*. The latest record was set up by S/L. J. C. T. Downey, D.F.C., in an Avro Lincoln (*Aries III*) when he flew from London to Khartoum, at an average speed of 220 m.p.h., in 14 hr 23 min. The previous record (180 m.p.h.) was made last May in a Commando of the Egyptian Air Force.

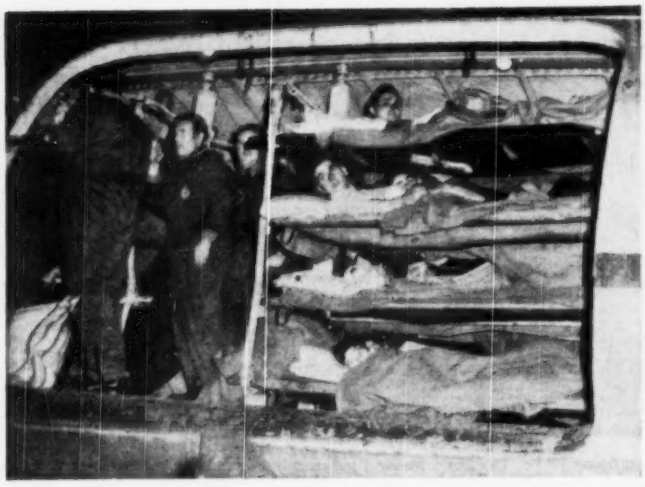
The two earlier records referred to—London-Darwin and London-Wellington—were set up in August, 1946, by an Avro Lancaster, *Aries I*, captained by A. Cdre. (now A.V.-M.) N. H. d'Aeth. Like the original *Aries*, the Lincoln now bearing this name has been modified by the addition of Lancastrian-type nose and tail fairings.

New Duty for the Hastings

AS mentioned in these columns last week, the Handley Page Hastings is now going into service with the Coastal Command meteorological squadron at Aldergrove, Northern Ireland. In this role, it promises to be a more efficient and more comfortable aircraft than the Halifax, which it replaces.

There is a set routine for the 1,600-mile Atlantic weather flights made by the squadron every day. From a point off the Irish coast the aircraft heads out over the ocean in a south-westerly direction, flying at 1,500ft. Every 60 miles observations are made of temperature, humidity, cloud conditions and visibility. Every 230 miles the aircraft descends to about 200ft to obtain an estimate of sea level pressure and temperature. After proceeding thus for about 800 miles it again descends to sea level, then makes a spiral climb over a fixed point to a height of 18,000ft, making observations at 11 selected levels on the climb. It then flies eastwards at 18,000ft for about 300 miles, continuing to take observations at 60-mile intervals, makes a spiral descent to record sea level data for the second time, then returns to base at 1,500ft following the same procedure as on the outward flight.

Average duration of flights will be reduced from nine to eight hours owing to the higher cruising speed of the Hastings. When the crews have gained more operating experience with the new aircraft the route may be extended and the altitude of the 300-mile high-level leg increased to take full advantage of the Hastings' greater range and better all-round performance.



AMBULANCE SERVICE: The first casualties of the Korean campaign to be brought back to Britain were aboard this Transport Command Hastings, from Singapore, which landed at Lyneham on November 22nd. As an ambulance, the Hastings can carry up to 32 stretcher-cases, 24 walking patients, four attendants and medical supplies. Reference to another version is made below.

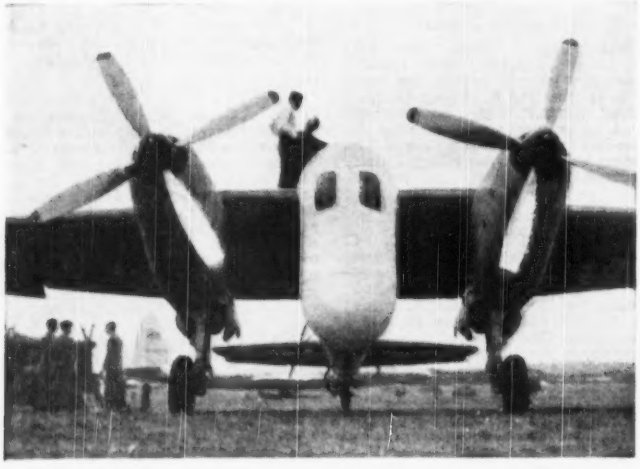
Groves Prizes Awarded

THIS year's L. G. Groves Memorial Prizes and Award, granted annually from a sum of money placed at the disposal of the Air Ministry by Major and Mrs. Groves in memory of their son (an R.A.F. meteorological observer killed shortly after the war), were presented at the Air Ministry on November 22nd. Major Groves gave away the prizes and Air Chief Marshal Sir Ralph Cochrane, Vice-Chief of the Air Staff, presided. The recipients were as follows:—

S/L. A. J. Barwood, M.R.C.S., L.R.C.P., of the R.A.F. Institute of Aviation Medicine, received the Prize for Aircraft Safety. His research in the laboratory and his practical studies in the field have, it is stated, made an outstanding contribution to the protection of flying personnel against temperature and climate.

Dr. Frank Pasquill, B.Sc., of the Meteorological Office, was awarded the Prize for Meteorology. His investigations into the exchange of heat and water vapour between grassland and the stratum of air immediately above it has yielded results of much interest to theory of turbulent diffusion, and of great value in its application to evaporation problems affecting agriculture and the forecasting of visibility and fog.

The Meteorological Observers' Award was presented to M. Plt. B. C. J. Calnan (now released), who completed over 90 met. sorties, involving over 820 hours' flying. His meritorious service and devotion to duty were a valuable contribution to the success of his squadron's long-range meteorological sorties.

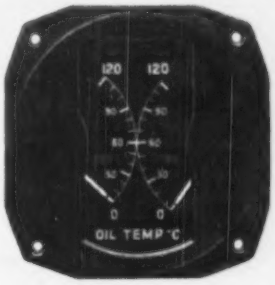


INSCRUTABLE EXPRESSION on the "face" of the Short S.B.3 anti-submarine aircraft. The well-designed fuselage nose—presumably housing search radar—and Mamba turboprops of this new carrier-borne type distinguish it from the Merlin-powered Sturgeon target-tower, from which it was developed. The Sturgeon, incidentally, is now going into service with the Navy.

No. 1 Temperature Measuring

The comprehensive range of Weston temperature measuring instruments covers the requirements of existing production aircraft, as well as types now under development. In addition to thermometry for the indication cylinder, air, oil and radiator temperatures, Weston equipment for aircraft includes instruments for power supply, navigational aid instruments, selector switches, etc.

WESTON
AIRCRAFT INSTRUMENTS



Illustrations show :
Above : Model 5128. Dual Engine Temperature Indicator, comprising two Millivoltmeters of 100° scale housed in large-size S.A.E. case. For use in conjunction with copper/constantan, iron/constantan or chromel/alumel thermocouples.
Below : Model 5127. Dual Ratiometer Indicator, comprising two 100° Ratiometer movements housed in large-size S.A.E. case. For use in conjunction with thermometer bulbs, electrical oil pressure transmitters, electrical position indicators or any combination of two of these to indicate a variety of temperatures, pressures or position.

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Weight - 15 ozs (With anti-vibration bracket - 18ozs).
Description - The switch unit is of the single pole, single throw, double break, snap action variety. It is rated to carry 5 amps non-inductive load at 24 volts D.C. and connection is made to it through a screw type terminal block fitted in the switch base and enclosed by a metal cap. The unit can be arranged to operate at either gauge pressure or at pressure measured from standard sea level.
Uses - In its original application the unit was actuated by oil pressure but it has many uses where simple on-off switching is required to be controlled by pressure variation.

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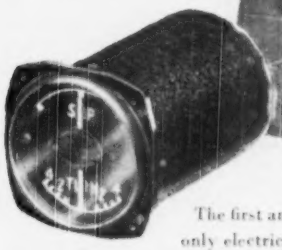

Photo by courtesy "FLIGHT"

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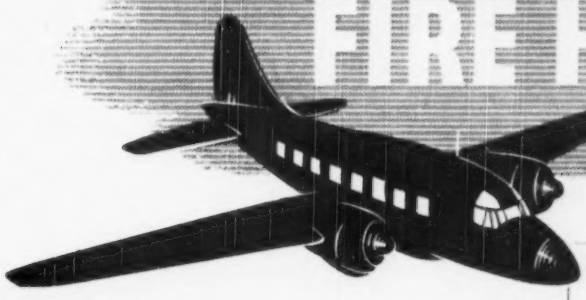

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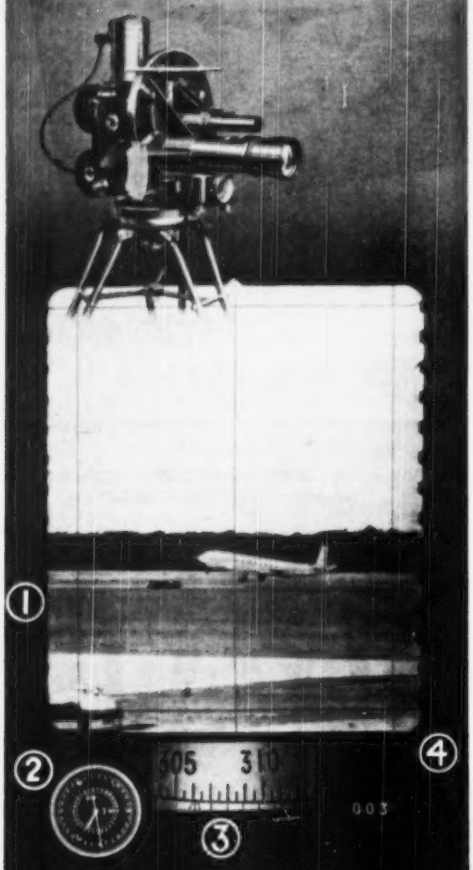

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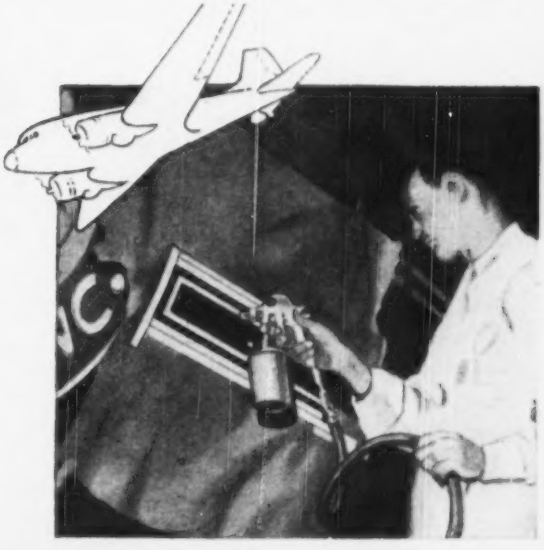

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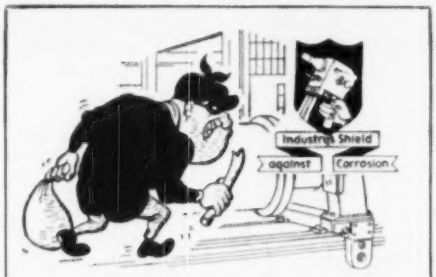

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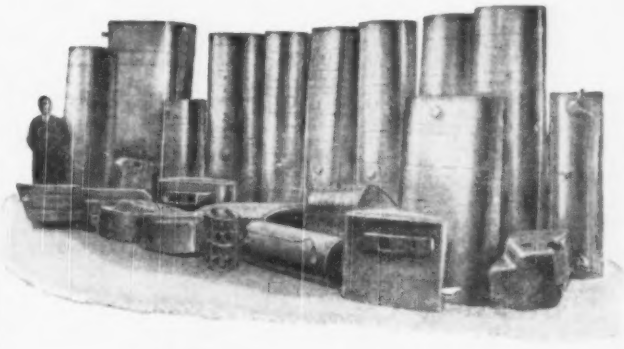

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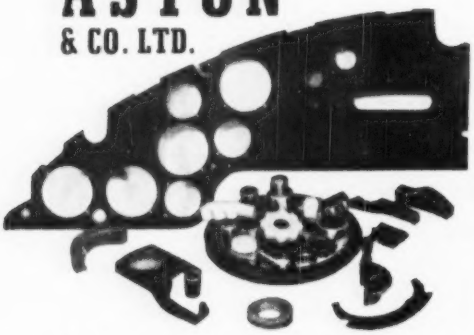

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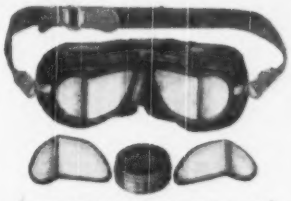

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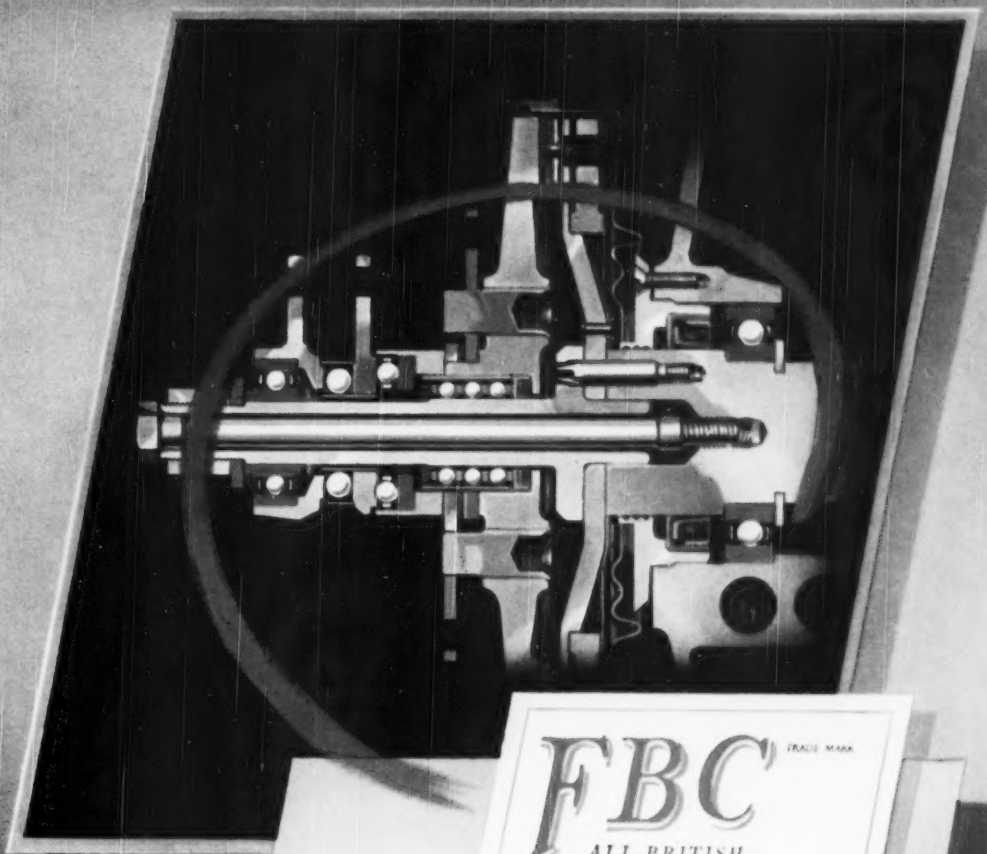

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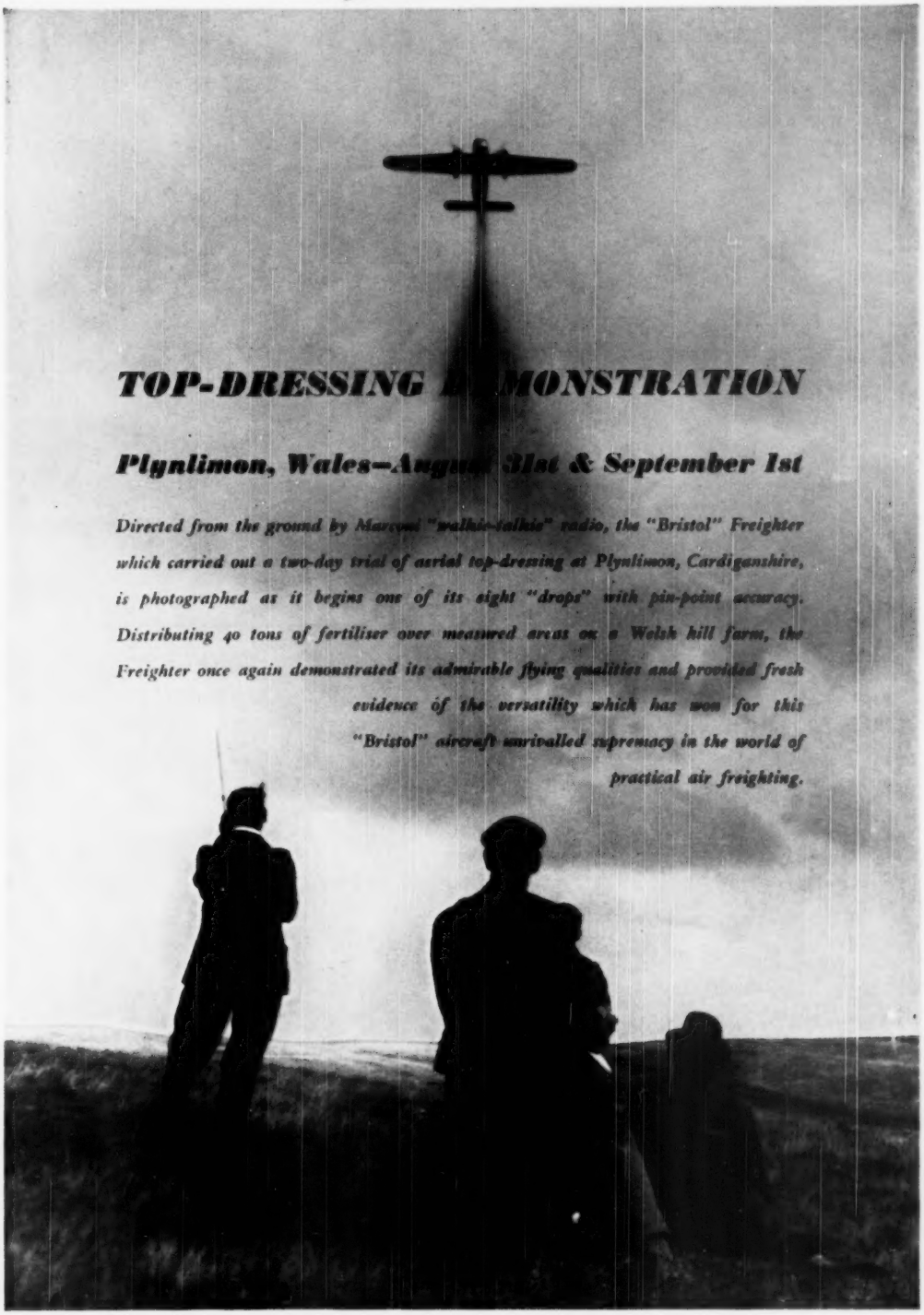

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